FEBRUARY 1960

PLASTICS

THE MAGAZINE OF APPLIED ENGINEERING

TECHNOLOGY

SPECIAL ISSUE

Facts on 1960

Compression and Transfer Molding Machines, Thermoforming Units and Auxiliary Equipment

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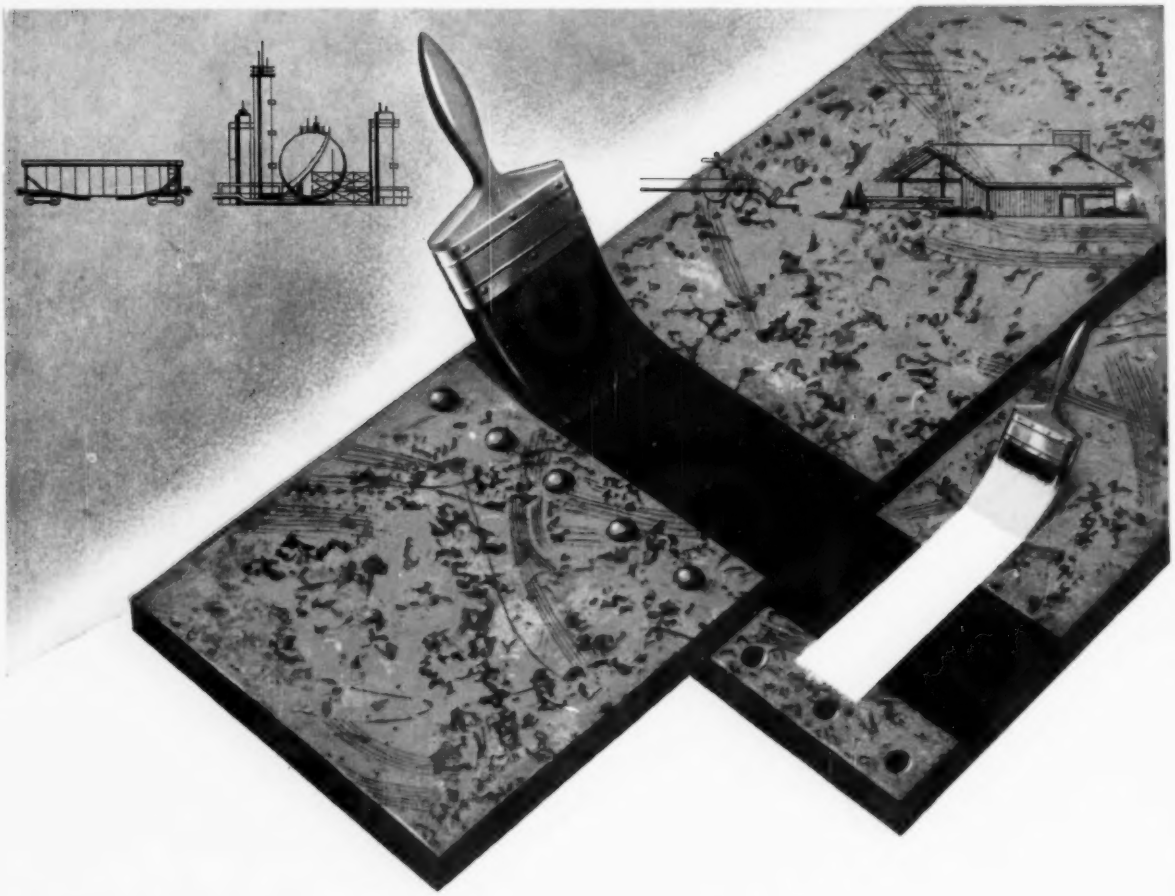

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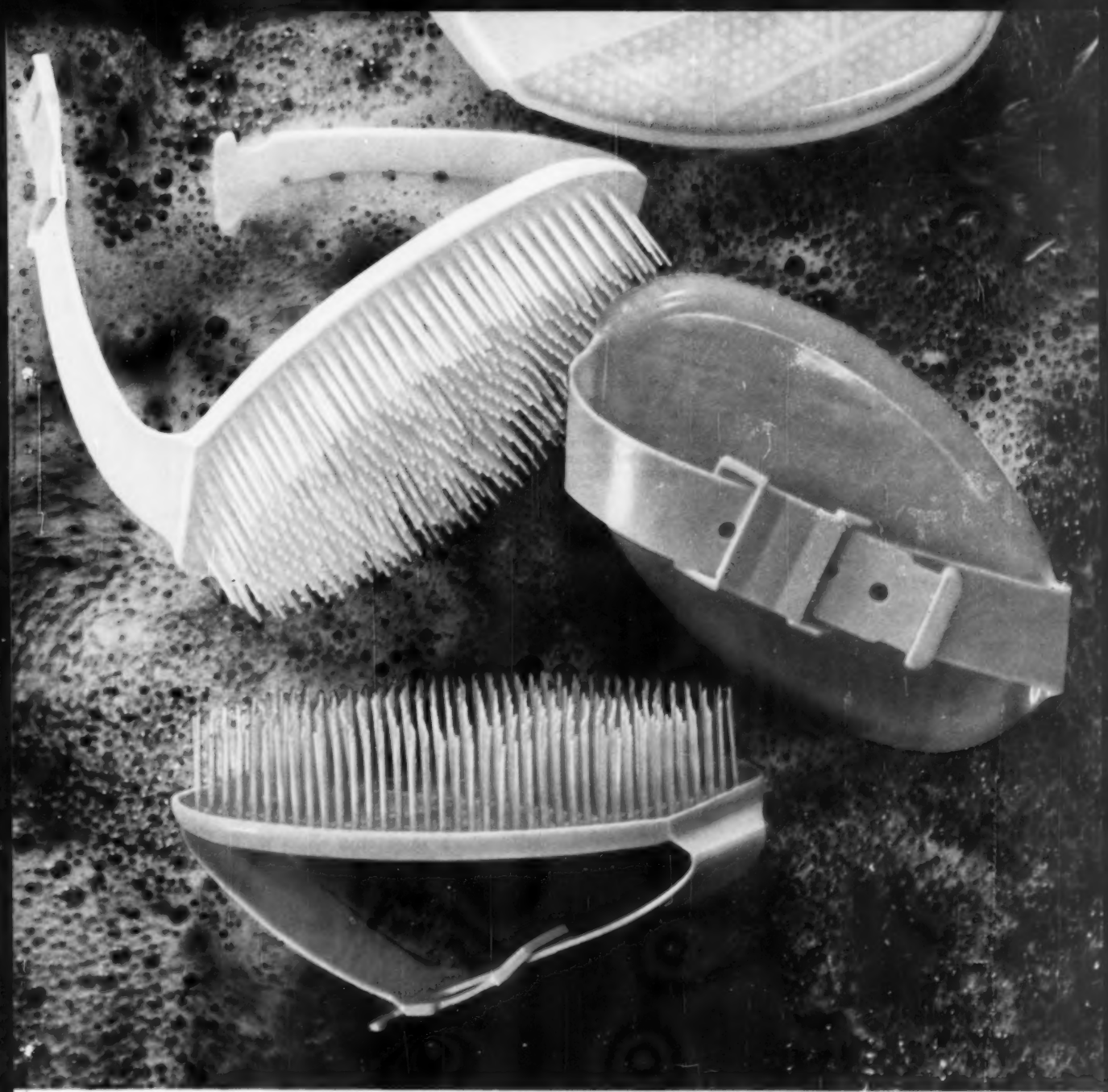

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Colorfully and attractively designed for the premium field, they are molded of unbreakable CATALIN Low Density POLYETHYLENE . . . as the preferred material . . . in order to couple low cost with outstanding resistance to soaps, detergents and hot water.

CATALIN POLYETHYLENE is available in the widest range of densities, from .915 to .96, with melt indexes from 0.2 to 50, to fulfill every requirement. The full roster of Catalin plastics also includes Polystyrene . . . in general purpose, high impact, heat-resistant, light-stable and anti-static grades, Styrene Copolymers, Nylons and the new Polypropylenes. Maintaining the highest standard of laboratory-tested product purity, Catalin offers molders, blow molders and extruders the widest variety of top-quality, cost-favorable formulations to fit their specific needs. Your inquiries are invited.

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PLASTICS

THE MAGAZINE OF APPLIED ENGINEERING

TECHNOLOGY

February 1960, V. 6, No. 2

feature article:

significant flow properties of thermoplastics ..... p. 35
by L. B. RYDER
The extrusion and molding behavior of thermoplastics can be understood and predicted by analyzing certain significant flow properties. Data are presented showing these flow relationships for three thermoplastic resins, and the equipment and data-handling procedures are described. The method presented overcomes the limitations inherent in present techniques for determining polymer fluidity, which are conducted at temperatures and stresses far removed from those existing in actual processing operations.

guest editorial:

look around you — polyurethane ..... p. 60
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what a plastics engineer should look for when planning to buy a thermoforming machine ..... p. 40
by W. M. RONAYNE

p.t's comparative data on 1960 thermoforming machines ..... p. 44

what a plastics engineer should look for when planning to buy auxiliary equipment for compression and/or transfer molding ..... p. 46
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Television Yoke molded in Celanese Fortiflex by Paragon Molding Company, 2001 North 15th Avenue, Melrose Park, Illinois

NOW...THREE FLAME RESISTANT FORTIFLEX FORMULATIONS

New flame resistant Fortiflex is used as insulation in television yoke

In view of the increasing use of Fortiflex A linear polyethylene in electrical appliances where fire hazards can occur, Celanese now offers this material in three flame resistant formulations:

- **FORTIFLEX A-70-12**
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These formulations provide a spread of melt indexes (0.7, 2.5 and 5.0 respectively), making it possible to mold a wide variety of flame resistant products. They are recommended for use in room air conditioners, refrigerators, electric motors, television sets, etc.

Flame resistant Fortiflex formulations are high density polyethylenes with a specific gravity of 1.04. They are available in opaque, white and black. Their stiffness, hardness and tensile strength are approximately the same as for standard Fortiflex A. However, heat distortion values under 66 psi are slightly lower and impact strength is somewhat reduced. Most important of all, the materials are self-extinguishing: burning rate or flammability is reduced to the point where they can be classified as non-burning materials under ASTM D-635-44.

Use Fortiflex flame resistant formulations wherever a self-extinguishing material is required.

More information is available. Write today for New Product Bulletin NP-35. Celanese Plastics Company, a Division of Celanese Corporation of America, Dept. 143-B, 744 Broad St., Newark 2, N. J.

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Letters to the Editors

Controversy on Publicity Value

Dear Sirs:

We were delighted by the Guest Editorial, "Publicity—An Obligation or a Sales Aid," in your December issue, pg. 45. It confirms what we have long suspected—namely, that there are two types of publicists: those who consider themselves as assistants to the nation's business press, and the others who feel that editors and publications were created only to be exploited. The entire tone of the article—even the title itself—establishes that distinction.

The heart of Mr. Schor's argument seems to be that publicity is purely and simply a sales tool. Only information which leads to an immediate dollar return is to be given to an editor. Any effort beyond that is extraneous, and not the function of the technical publicist. Take, but don't give.

We do not concur with Mr. Schor. We still feel that a publicity agency or department has a moral obligation to be of service to an editor in every possible way. However, because this is purely a matter of philosophy, there really is no sense in arguing the point. The only factor worth mentioning is that editors agree with our premise, not only in conversation, but in print in their own publications. We wonder how many editors will appreciate Mr. Schor's standpoint, assuming that he sends them reprints of his article as we did (October Guest Editorial, pg. 41).

It is difficult for many clients to understand that in technical publicity, the man who pays the piper does not call the tune. Our primary responsibility is to the editor who has to supply full working information to his readers, not to the client who insists on company mentions and trademarks in every paragraph. You can't continue taking for very long without giving a little in return. Editors find out very quickly when they are being used.

Actually, although Mr. Schor's reply purports to have been prompted by our Guest Editorial in the October issue, we wonder. It seems that either he did not read ours very carefully, or he has erected a very elaborate strawman to carry his commercial. Then, he dissects his own creation in order to make us defend a position we never took in the first place.

We did not suggest revealing real secrets, even mentioning that in some cases it might make patent application more difficult. However, we did (and still do) recommend that information which is likely to become, or may already be, common knowledge through other sources be released for publication. Thus, the company may take credit in the technical press for its own developments before the competition does.

Without question, technical publicity is a valuable sales tool. But, like any tool, it will not stay sharp very long if abused. Probably both ways—the hard sell and the service approach — are legitimate: we are in no position to act as a judge. We can only cling to our strong conviction that the mark of a successful publicist lies in how often he is asked by editors for information, rather than in his ability to overrule their judgments when they consider a story meaningless or incomplete.

L. R. Greif, Pres.
Greif-Associates, Inc.
New York, N. Y.

* * *

Urethane Foaming Machines

Dear Sir:

My company is seriously considering the purchase of a urethane foaming machine.

In view of your extensive knowledge of the field, we ask you to advise us of the names and addresses of all the companies (of which you are aware) that manufacture foaming equipment for the continuous production of flexible polyurethanes by the prepolymer and/or one-shot methods.

M. W. Uffner,
Perlfoam Co.
Houston, Tex.

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation and address.

A letter will not be printed if publication is not desired by the sender, and the identity of the writer will be withheld, if desired.

—The Editor

PREVIEWS

of Next Month

The March issue will feature the following articles:

Oxidation in Extrusion. R. C. Phelps, Group Leader, and R. F. Kowal, Customer Service Engr., Polymer Service Labs., U. S. Industrial Chemicals Co., Tuscola, Ill.

Factors leading to excessive oxidation in extrusion are shown to be numerous, and to be due mainly to inadequately-designed equipment and improper operating conditions. In the first category are screw design, streamlining of polymer flow, choice and location of temperature-controlling devices, and properly-rated heaters. Improper operating conditions can result in gels or fisheyes in blown or flat films, and pimple-like imperfections in heavier extrudate sections. The use of inert-gas blanketing of polyethylene extruder feed is mentioned, together with its role in preventing excessive oxidation.

•

Heat-Resistant Encapsulating Resins. M. M. Lee, Polymer Specialist, and R. D. Hodges, Mgr. of Chem. Research & Devel., Fort Wayne Laboratory, General Electric Co., Fort Wayne, Ind.

The heat-resistance values for several types of encapsulating resin systems are of major importance because of the effect of high temperatures on many significant properties. The heat-resistance of such a resin system should be evaluated not only on the basis of one property, but on the results obtained in a combination of thermal tests. A complete evaluation of the resin can only be determined by applying it in the special end-product.

•

Fabricated (Built-Up) Molds. Carl Zehr, Pres., Carl Zehr Co., Ashtabula, O.

Low-bulk, low-pressure glass/polyester molding materials offer new possibilities in product design and mold construction. Advantages of fabricated molds are given in comparison with costs for conventional high-pressure molds. Examples of three current applications for the new mold-making technique are discussed in detail.

•

The Guest Editorial will be **"Plastics Automotive Applications and Tooling,"** by William P. Gobeille, Plastics Operation Mgr., American Motors Corp., Detroit, Mich.

•

IF PHENOLICS CAN DO IT, **PLENCO** CAN PROVIDE IT
AND DOES—FOR **AMPHENOL**

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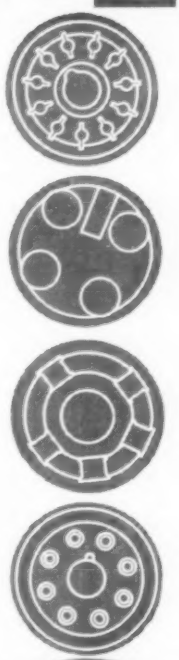
phenolic molding compounds



IN MISSILES, in aircraft, in communications, computers, and other electronic equipment, all important *connectors* "hook up" to keep energy on the go. They have to be molded of materials that can stand up to high heat, extreme cold, rough handling.

Amphenol Connector Division of Amphenol-Borg Electronic Corporation, leading U.S. producer of these electromechanical components, finds the answer in the broad selection of Plenco *general-purpose* molding materials.

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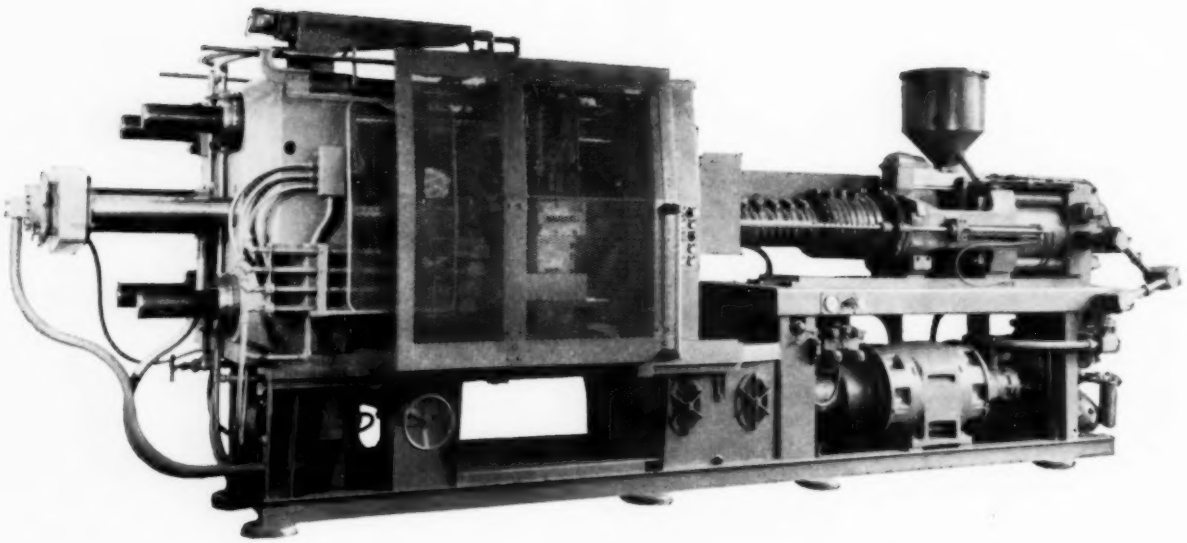

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The size of the new HA16-425 "Impco", combined with its speed and adaptability, make it Injection Molding's most versatile performer! Seven hundred and twenty dry cycles per hour at full 24½ inch stroke — two hundred pounds per hour plasticizing capacity — hydraulic knockout — live adjustments, are but a few of the many features contained in this machine. Let us show it to you.

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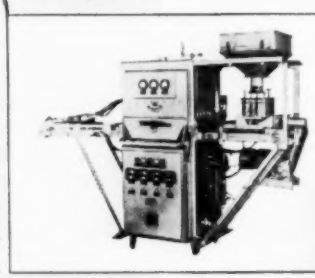

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TROY
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Lasting and lustrous—because it's made of PLIOVIC!

Surprising as it may seem, you're looking at a fabric supported vinyl upholstery. It's called *Milano* and, for the first time, combines the soft shimmer of moiré silk with the washability, wearability and general durability of vinyl.

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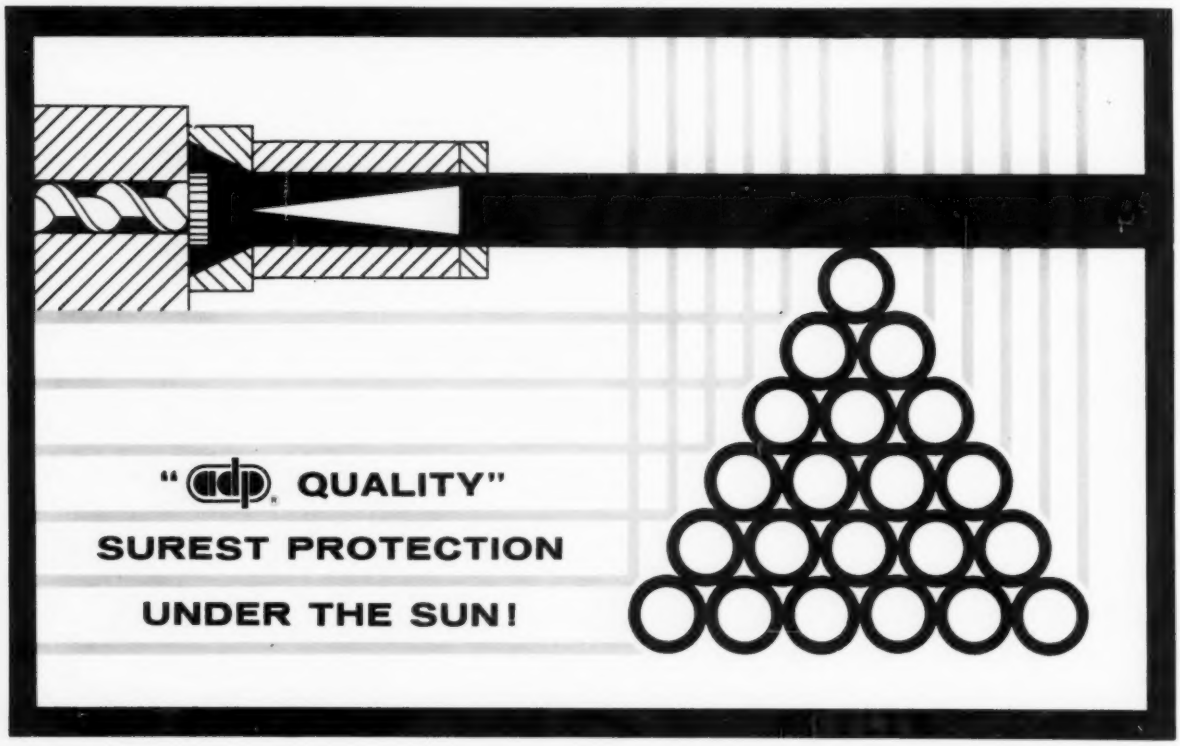

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Write today for a sample of ADP concentrates in the resin you require . . . or let Acheson specialists work with you to solve your special coloring problems.

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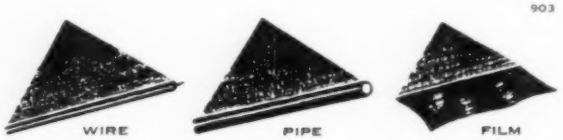

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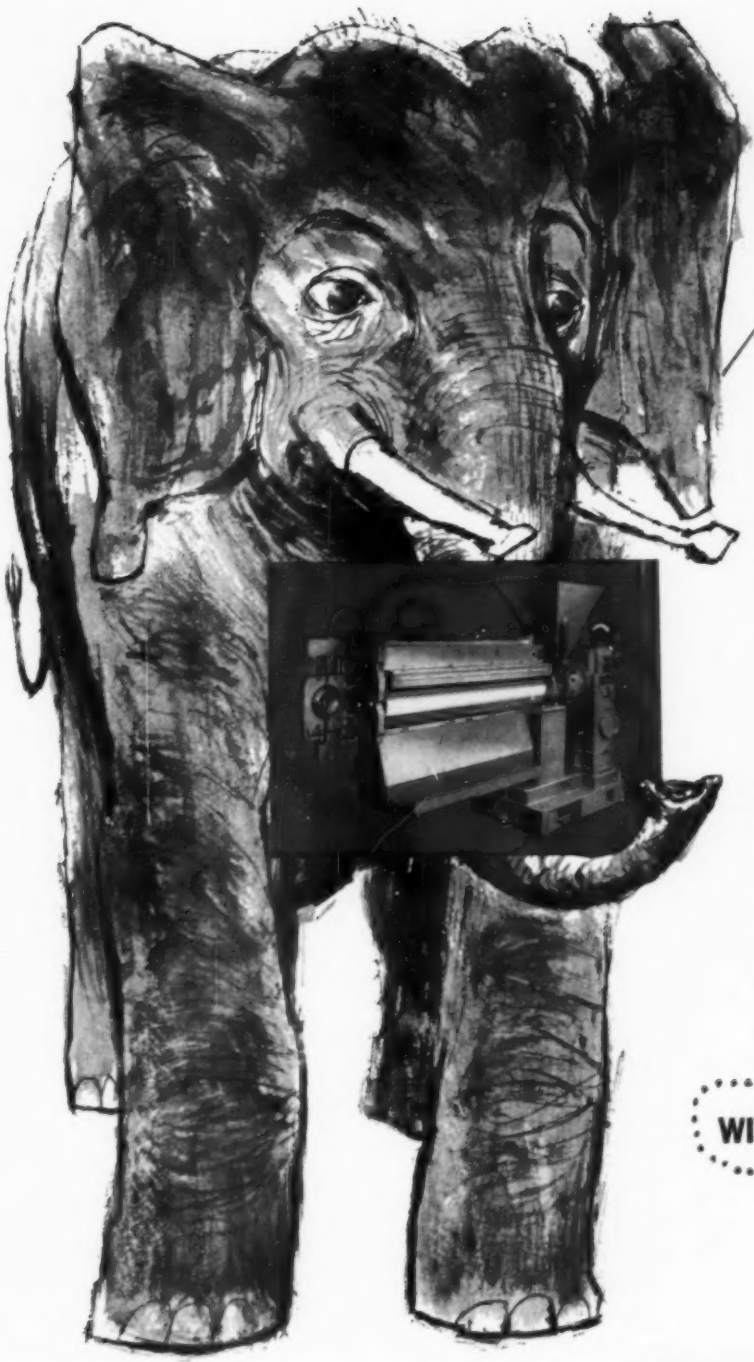

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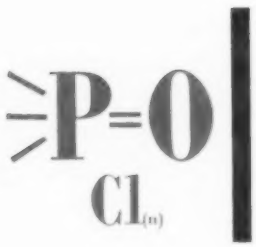
CELLUFLEX TPP: *Triphenyl phosphate.* Excellent fire resistance, good flexibility. Produces clear, tough compositions. Widely used for cellulose acetate.

CELLUFLEX 112: *Cresyl diphenyl phosphate.* High degree of flame resistance in vinyl formulations. Improved low temperature and light exposure properties.



CELLUFLEX CEF: *Tris beta-chloroethyl phosphate.* Exceptional flame retardance.

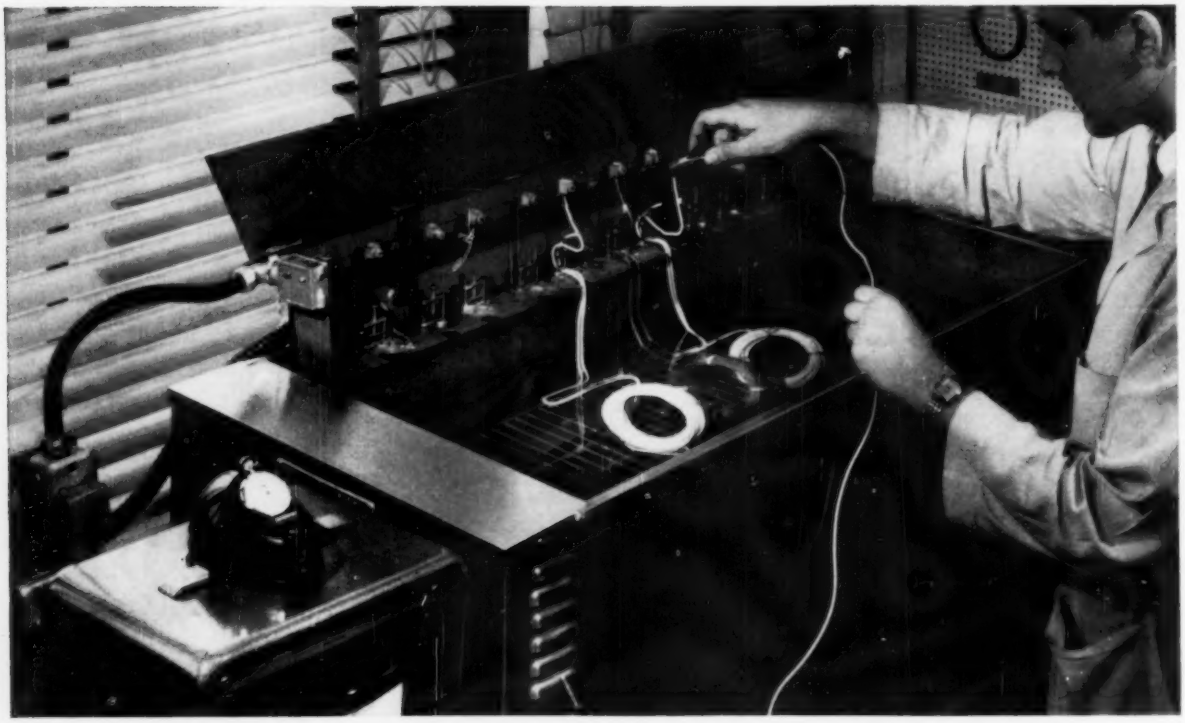
CELLUFLEX FR-2: *Tris dichloropropyl phosphate.* Exceptional flame retardance. Effective with wide variety of resins, both thermoplastic and thermosetting.

CELLUFLEX 23: *Alkyl epoxystearate.* Economical low-temperature plasticizer and stabilizer for polyvinyl chloride and other polymers. Very low volatility.

A thought to keep in mind—Celanese' shipment policies permit quick action to meet tight schedules. We ship from convenient points throughout the United States. We'll be glad to provide you with specifications on any of these plasticizers. For more information, write to: Celanese Chemical Company, a Division of Celanese Corporation of America, Dept. 564-B, 180 Madison Avenue, New York 16, N. Y.

Celanese® Lindol® Celluflex® Celluphos®

Canadian Affiliate: Canadian Chemical Company, Limited, Montreal, Toronto, Vancouver
Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16, N. Y.



Immersion test proves DYTHAL stabilizer gives top performance to 75°C THW vinyls.

How DYTHAL® stabilizer is helping the electrical industry develop a new insulation, 75°C THW

. . . improved vinyl stocks will lift rating of building wire by 15°C

"More 'housepower' needed soon!", say architects.

And the electrical industry is getting set to oblige . . . developing *new* vinyl insulation stocks (THW) that are (1) readily extrudable, (2) pass 12-week, 75°C immersion tests with flying colors.

In compounds that meet these high standards, a National Lead Company stabilizer, DYTHAL, is proving to be an exceptional product.

Tests . . . confirmed by leading insulation producers . . . show that DYTHAL stabilizer is by far the most compatible and the most efficient stabilizer to use in stocks such as these. It confers superior heat stability. It promotes excellent extrusion properties. It does not affect sensitive plasticizers.

What's more, DYTHAL stabilizer is well adapted to an electrical compound. It disperses uniformly. It does not produce gassing or porosity. It is highly resistant to water extraction and to moisture pick-up.

Other National Lead stabilizers do as much for other vinyl stocks

DYTHAL stabilizer is only one of the National Lead Company stabilizer developments now benefiting electrical stocks. Six more (see box) are widely used. Still other National Lead Company stabilizers overcome process or service problems of other vinyl stocks.

For information on these National Lead Chemicals, for application help . . . just write.

6 other stabilizers developed by National Lead Company improve vinyl electrical insulations

- DYPHOS® stabilizer for top-notch light-and-weather-resistant jacketing, other outdoor insulations.
- LECTRO "60"® stabilizer provides economy in 60°C compounds . . . in higher-rated vinyls, blended with other stabilizers.
- TRIBASE* and TRIBASE-E* stabilizers boost heat resistance of 60°C 7, TW, SPT stocks at low cost.
- LECTRO* 77 stabilizer meets requirements for primary insulations up through 80°C types.
- LECTRO* 78 stabilizer improves special high-temperature stocks including flexibles, rigids, electrical-grade plastinols.
- DS-207® stabilizer-lubricant improves heat resistance, extrusion characteristics, water resistance of vinyl.

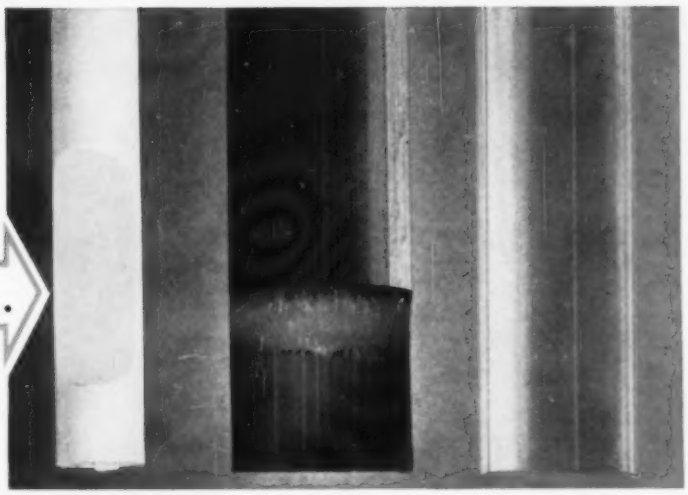
*Trademark

A Chemical Development of **National Lead Company**

111 Broadway, New York 6, N. Y.

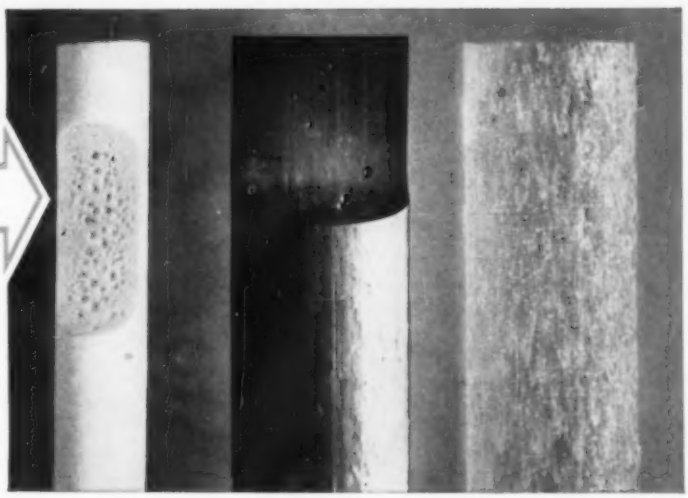
In Canada. CANADIAN TITANIUM PIGMENTS LIMITED, 1401 McGill College Avenue • Montreal

make them like this...



dry blend PVC extrusions

instead of like this...



RIGID RIGID FLEXIBLE

New ESCAMBIA dry blend resins—plus new production techniques—now make possible the low-cost volume production of vastly improved extruded products. As can be seen from the unretouched photographs above, both rigid and flexible products can be made remarkably free of porosity and surface imperfections normally found in dry blend extrusions. As in other applications, ESCAMBIA PVC resins give you the additional benefits of outstanding heat stability, excellent color, unusual clarity, and high surface gloss. For more details on how you, too, can produce better products at a lower cost, contact your ESCAMBIA sales representative or write direct.

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CHEMICAL CORPORATION
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This Month In Brief

"Plastics Processing Machines - Part I" is the title of this month's Editorial, noting that this is the first of three special issues planned for this year to deal with various categories of plastics processing machines and auxiliary equipment. Part I covers thermoforming machines, and compression and/or transfer molding machines. Part II, to be published in May, will cover injection molding machines, while Part III, to be published in September, will deal with both extrusion and blow-molding machines. These special issues on 1960 machines will merit your careful consideration and retention in your "working file."

An optimistic prediction for polyurethane is given in the Guest Editorial. J. L. Marzak, Mgr. of Market Research for Allied Chemical's National Aniline Division, foresees the use of one-million pounds of polyurethane daily in at least five years. In fact if current trends continue, we will be surrounded by polyurethane products by 1965.

Some notes on the Technical Articles in this issue are as follows:

The lead article, "Significant Flow Properties of Thermoplastics," shows how the processing behaviors of thermoplastics can be predicted by analyzing the results obtained in various simple test determinations.

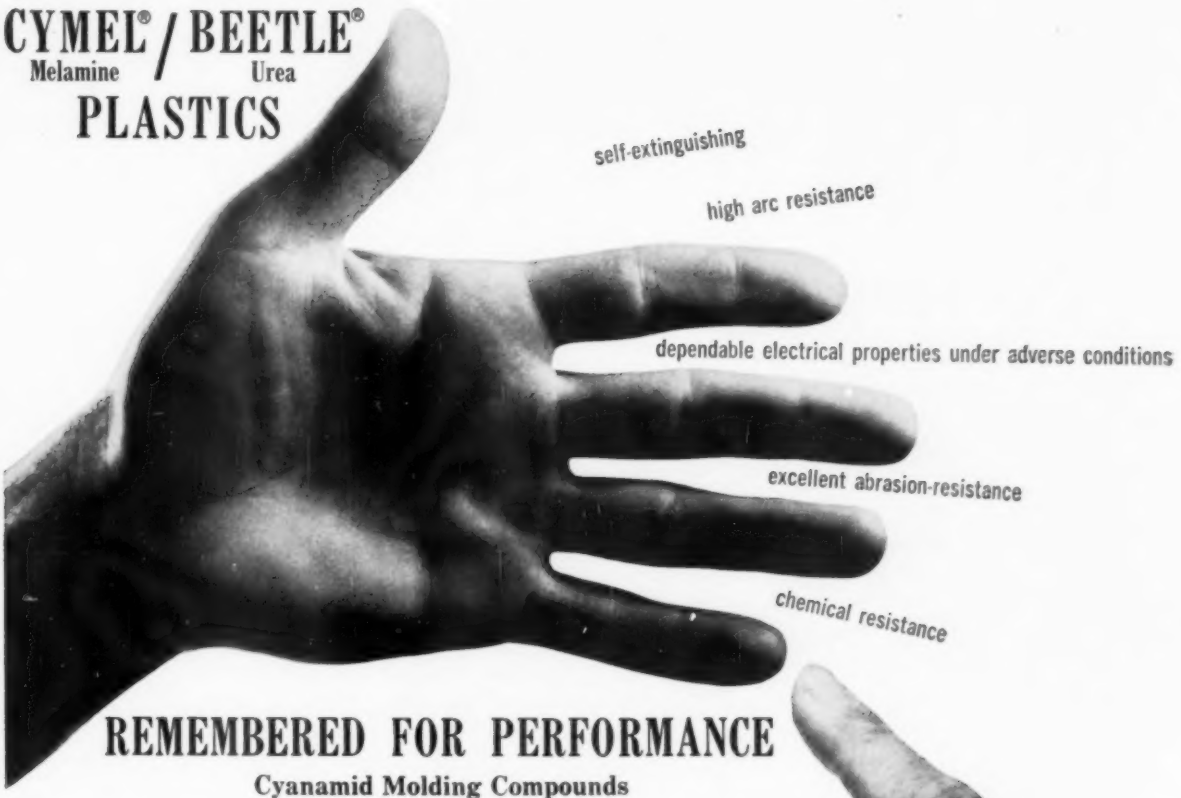
"What a Plastics Engineer Should Look for When Planning to Buy a Thermoforming Machine" gives a series of guide posts that will assist in determining the type of equipment to best suit your forming needs.

"What a Plastics Engineer Should Look For When Planning to Buy Auxiliary Equipment for Compression and/or Transfer Molding" notes the important features that will make your auxiliary equipment useful and practical.

Polyester resins and their place in an expanding market are discussed in Lee Zukor's engineering section, Exploring Fabrication Techniques, this month. The section deals with the chemistry of polyesters, the effects of different compounding ingredients, physical properties obtained, applications for glass-reinforced polyesters, and the beginning of a concise engineering survey of the various methods for molding these products.

Only one Engineering Forum column, on Injection Molding, this month. Dealing with "The Refinement of Hot Runner Molding," the column covers obvious advantages of this molding technique, together with the possibilities inherent in some of the various modifications now employed.

CYMEL® / BEETLE®
Melamine / Urea
PLASTICS



REMEMBERED FOR PERFORMANCE

Cyanamid Molding Compounds

CYMEL 3135-3136 (glass-filled) Additional distinctive properties: outstanding electrical properties; high impact resistance; extraordinary flame resistance; good dimensional stability. Typical applications: circuit breaker boxes; terminal strips; connectors; coil forms; stand-off insulators. Specifications: Cymel 3135 (MMI-30, MIL-M-14E, Federal L-M-181 Type 8; ASTM D704-55T Type 8); Cymel 3136 (MIL-M-19061, MMI-5).

CYMEL 592 (asbestos-filled) Additional distinctive properties: resistance to atmospheric extremes; high dielectric strength. Typical applications: connector plugs; terminal blocks; a/c, automotive and heavy duty industrial ignition parts. Specifications: MIL-M-14E MME; Federal L-M-181 Type 2; ASTM D704-55T Type 2, SP1 SPEC NO. 27025.

CYMEL 1077 (alpha-cellulose-filled) Additional distinctive properties: Surface hardness, heat resistance, unlimited color range. Typical applications: appliance housings, shaver housings, business machine keys. Specifications: MIL-M-14E – Type CMG (in approved colors); Federal–LM 181 Type 1; ASTM D704-55T Type 1, SP1 SPEC NO. 30026.

CYMEL 1500 (wood flour-filled)–**CYMEL 1502** (alpha cellulose-filled) Additional distinctive properties: Good insert retention. Typical applications: meter blocks; ignition parts; terminal strips. Specifications: Cymel 1500 (MIL-M-14E Type CMG; Federal L-M-181 Type 6; ASTM D704-55T Type 6); Cymel 1502 (MIL-M-14E Type CMG; Federal L-M-181 Type 7; ASTM D704-55T Type 7).

BEETLE® UREA (alpha-filled) Additional distinctive properties: Economy of fabrication; economy of material; myriad translucent and opaque colors. Typical applications: wiring devices; home circuit breakers; tube bases; appliance housings. Specifications: Federal L-P-406A, LC 726-1, ASTM D705-55, Grade 1 (Arc resistance limits are in process of revision by ASTM), SP1 SPEC NO. 27026.

CYANAMID

WRITE FOR COMPLETE TECHNICAL DATA.

AMERICAN CYANAMID COMPANY • Plastics and Resins Division • 30 Rockefeller Plaza–New York 20, N. Y. Offices in: Boston Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Detroit • Los Angeles Minneapolis • New York • Oakland • Philadelphia • St. Louis Seattle. In Canada: Cyanamid of Canada Ltd., Montreal and Toronto.

What's New in Processing

Resonant-vibration control in such critical components as printed circuits and structural laminates has been simplified through new processes developed by **Barry Controls, Inc.,** a dynamics-engineering design firm located in Watertown, Mass. The firm "designs-in" or adds damping action by special laminated and cellular construction. Sheets and other shaped laminates of plastic or metal are separated by a viscoelastic damping medium. Flexing under impressed vibration causes the lamination to slide within the limits imposed by the viscoelastic material's rate of shear and its capacity for absorbing the energy of resonance. Since temperature extremes will affect the degree of damping, no one material can be used as the viscoelastic medium; however, different silicone formulations tailored to the end-use conditions have been used successfully. These materials must, of course, have inherent adhesive properties.

Processing advantages, lowered costs, and new applications are offered the epoxy processor by **Food Machinery & Chemical Corp.,** through the introduction of three new epoxy resins. Called Oxirons, they differ from conventional epoxies in molecular structure and can be cured with low-cost anhydrides, acids, and glycols. Since they display very little room-temperature reactivity with polyamines, but react readily at 100-150° C., they are especially useful to the laminator who requires a long pot-life. Densities are about 20% less than conventional expoxies.

Patents

2,878,650 L. C. Krchma to Socony Mobil Oil Co.—a method of cooling thermoplastic and viscous materials which are not miscible with water. It involves passing the heated material through water in a conduit; admixing a controlled, small amount; discharging the mixture into a vaporizing space; and permitting the escape of water vapor.

2,879,005 E. A. Jarvis—a method of refining scrap plastic by chopping into coarse, discrete particles; introducing a liquid refrigerant at about —120° F. to embrittle the plastic portion; and pass through a shaker screen to separate.

2,879,179 F. E. Wiley to Tober Baseball Mfg. Co.—a method of applying plastic covers to baseballs by rotating the ball so that its equatorial circumference contacts a viscous latex. The axis of rotation is changed several times so that many bands are deposited to cover the ball entirely.

2,879,547 J. F. Morris to the Kendall Co.—a method of making fused film laminates. Molten thermoplastic is deposited at the nip between a moving, carrying surface and a first converging surface to form a layer which then contacts a molten bulk of chemically-different thermoplastic. These converge at a second nip and, one of the thermoplastics being a pressure-sensitive adhesive, they fuse.

2,879,617 S. J. Popeil—a method for manufacturing artificial foliage, plant life, and similar shapes in an aluminum sheet mold with a plurality of female recesses defining a leaf pattern and stem. The plastic and fiber are heated to cure in a conveyor oven and stripped before cooling to impart a life-like curved appearance.

Abstracts

"Some Fundamental Aspects of Fluidized Bed Coating" were explained by Joseph Gaynor in the December issue of the SPE Journal. Three coating techniques were described, all based on the fluidized bed: heating the substrate and dipping it into the fluidized bed; using electrostatically charged particles; and using a thin, tacky undercoating. Also in this issue was an article by C. J. Metz on "The Thermal Incline as an Evaluation Tool in Fluidized Bed Coating," which gives a method for measuring the flow of coating powders at different temperatures.

"1960—Crossroads for Injection Molding" by A. R. Morse appeared in the December issue of Plastics Industry, and discusses problems and futures in a general way.

U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

FEBRUARY, 1960 — U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation — 99 Park Ave., N. Y. 16, N. Y.

Packaging Notes

Skin suspension packaging with polyethylene film is being used with great success for shipping pottery and ceramic products.

The packages consist of a low density polyethylene skin suspension on a polyethylene-coated corrugated board. The coated board is perforated to allow a vacuum to be drawn through it. Then, products are placed on the board and 6-10 mil polyethylene film is heated, vacuum formed around the products, and heat sealed to the board. The completed unit is packaged in a corrugated container for shipment.

This packaging technique has cut gross shipping weight by 40%, and in-transit breakage has been reduced by more than 60%.

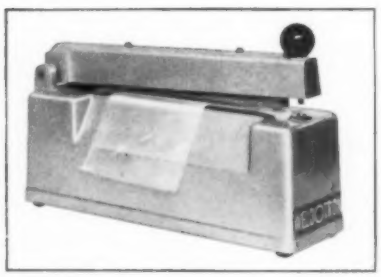
Now... polyethylene packaging for people!

A rectangular-shaped tent of polyethylene film is currently being marketed for use at football games and other outdoor sporting events. The tent is opaque except for a clear polyethylene viewing window. The tent keeps heat in — rain and snow out.

Polyethylene film packaging for carbon-steel tubes has proved to be economical for a New Jersey refinery.

Polyethylene film is wrapped around a cluster of tubes and taped securely closed. Wrapping with polyethylene in this way protects the tubes from rust and corrosion during storage.

Another advantage: packaging cost is said to be one-eighth that of the military-style moth balling the company formerly used.



A polyethylene bag sealer for small lots and laboratory use is now being marketed by a New Jersey Company.

The new compact polyethylene heat sealer is only 4 inches wide and 12½ inches long. It is portable and may be plugged into a standard 110 to 120 A-C outlet. The sealer will produce seals up to eight inches long. Sealing time is one-half to two seconds, according to the thickness of the film.

Improved Film-Clarity Meter Designed by U.S.I. Chemist

New Instrument Eliminates Human Error in Testing Clarity

A research chemist at U.S.I. has designed in conjunction with A.S.T.M. a new light transmittance meter which eliminates human error in testing clarity of polyethylene film. The instrument determines the relative amount of light transmitted through any film specimen at essentially a zero angle of scatter.

This new low-angle light transmittance meter was developed at the Polymer Service Laboratories of U. S. I.

The new meter is designed to replace the optical bench test . . . a method which depended on the operator's eye-sight. With the new meter, test results are recorded automatically, without relying on the judgment of the operator.

Operation of the Meter

Basically, the meter consists of a light source which is concentrated through a sample of film onto a light-sensitive cell. The cell is attached to a galvanometer which measures the amount of light passing through the sample to be analyzed.

Swatches of polyethylene film 1.5 mils thick were used as standard gauge samples by U.S.I. Care was used in handling the samples, since fingerprints on the film could cause variations as much as 10% in light transmittance.

Meters of this type are currently being evaluated by other laboratories in an A.S.T.M. round robin test.

New Polyethylene Packager Cuts Labor Costs by 50%

A west coast manufacturer recently announced a low-cost packaging machine which fills, closes and produces a finished bag in a single operation. It is designed to use bulk rolls of polyethylene film, and packages items which range in size from pencils to shirts.

The machine is said to cut packaging labor costs up to 50% through speed and efficiency of operation. The unit eliminates time-consuming hand loading of pre-manufactured bags. It reportedly eliminates set-up time, since no adjustment is necessary when changing from large to small size bags.

It is also reported that the machine can be operated by personnel who have no previous training or experience in packaging.

Now... Disposable Boots of Clear Polyethylene!

Low in cost, but high in protection are features claimed for newly introduced clear polyethylene boots. These disposable boots are easily pulled over regular shoes, and can be worn open at the top or closed with a rubber band.

Uses suggested for these inexpensive boots include biological and atomic laboratories where control of contaminated elements is vital.

The manufacturer currently packages his product in rolls of 50 and 100, and says average cost is less than 14¢ per pair. The boots are watertight, and last for several hours before wearing through, it is claimed.

Polyethylene Pipe Solves Difficult Tamping Job

Polyethylene pipe has been put to an interesting use in blasting operations for a new Potomac River water treatment plant near Washington, D. C.

A total of 62 holes were drilled to prepare a 110 ft. high cliff for blasting. Fourteen of these holes were from 35 to 96 feet deep and drilled at an angle of 32°. Since the density of the rock formation varied, there was a chance that the bore holes would swing out of line by several feet. Of major concern was the problem of loading and tamping blasting charges to the required depth in the crooked holes. Conventional, non-flexible, metal rods quite obviously would not do the job.

The blasting contractor solved the problem by using 1½" intermediate density hollow polyethylene water pipe. The highly flexible polyethylene tamping "pole" was made up of several sections of pipe.

It easily took the bends in the holes and was used successfully to tamp all required blasting caps and powdered charges in place.

DO YOU HAVE a new polyethylene packaging development you'd like the industry to know about? Make it routine to send your information on new developments to U.S.I. POLYETHYLENE NEWS.

Address the Editor,
U.S.I. POLYETHYLENE NEWS, U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corp., 99 Park Avenue, New York 16, N. Y.

exceptional moisture and grease resistance

POLYETHYLENE-COATED KRAFT OPENS UP NEW OPPORTUNITIES FOR CORRUGATED BOARD

Polyethylene-coated corrugated board — produced on conventional corrugating equipment — is extending the usefulness of corrugated into many new packaging applications.

This unique container board has exceptional moisture and grease resistance and a glossy, non-abrasive liner surface that will not scratch or mar package contents.

Extruders who produce polyethylene-coated kraft liner board can get these extra advantages by using U.S.I. PETROTHENE® polyethylene resins:

HIGH PRODUCTION RATES—PETROTHENE resins have good drawdown properties, permit extrusion at high speeds.

EXCELLENT ADHESION — with minimum hot melt oxidation.

NO ODOR — an important consideration in many packaging applications.

Contact U.S.I. for information on PETROTHENE resins especially suited for coating kraft liner board.

Packagers are investigating polyethylene-coated corrugated board for applications like these:

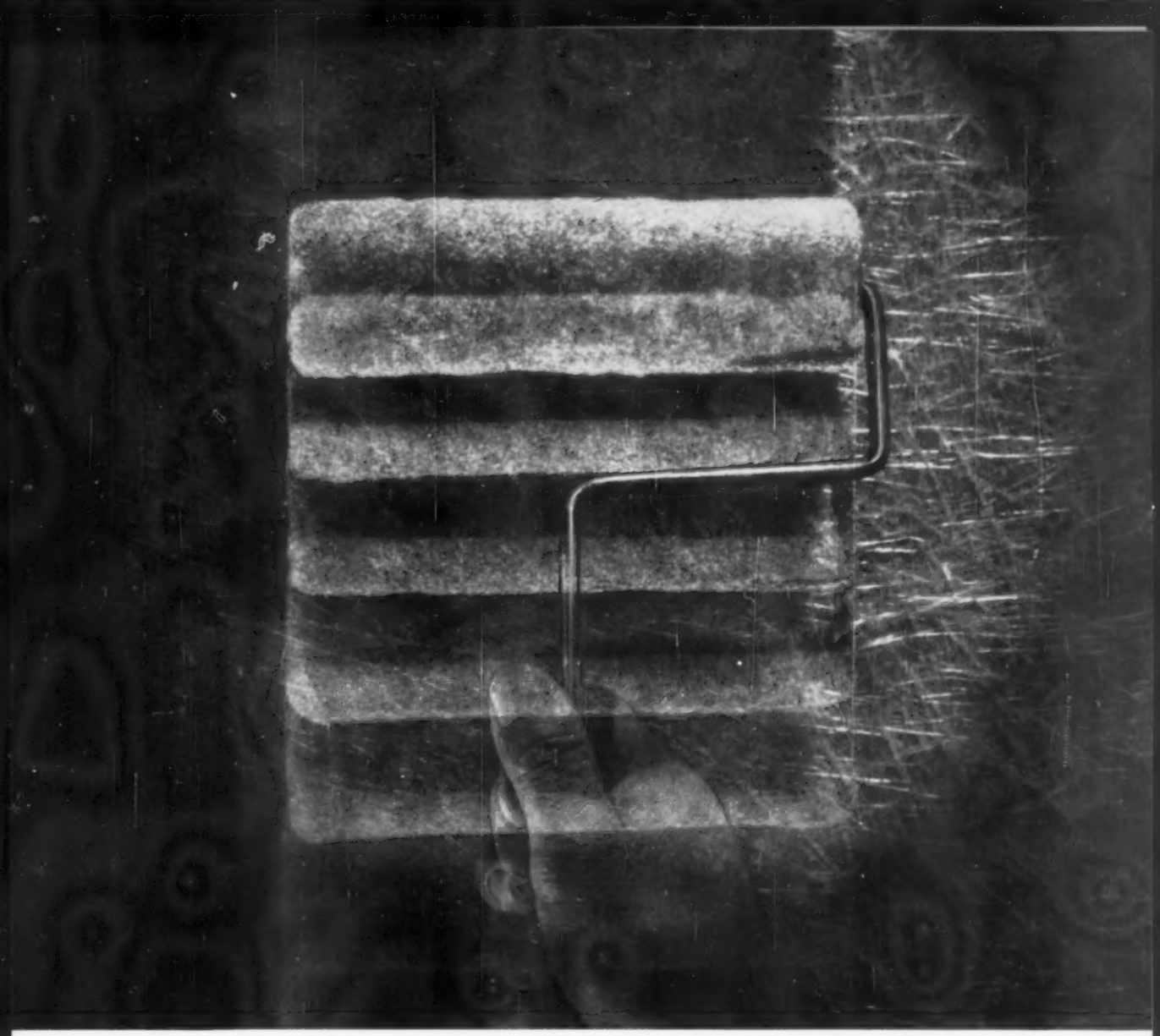
Bulk shipment of meat, where moisture and grease-proof interiors reduce weight loss of the meat and keep moisture from weakening the carton.

Shipment of furniture and other hard goods, where abrasion damage from the container has been a problem.

Bulk bakery and confectionery shipments, where absence of grease-wickage makes containers suitable for reuse as point-of-sale displays.

In concrete construction forms, where the polyethylene coating acts as a release agent.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities



Leading roll in resin performance

Layup time is reduced, wasteful flooding eliminated, production rates increased.

Faster wetting, rapid curing GLIDPOL layup resins make these dramatic savings possible wherever they are used in the reinforcement of plastic parts.

GLIDPOL layup resin systems are ideally suited to the manufacture of boats, bathtubs, sinks, swimming pools, truck bodies, panels, tanks and other products by the hand layup technique. Write for complete information on the resin system best designed to meet your particular requirements.

QUALITY Glidden PRODUCTS

RESINS FOR EVERY APPLICATION

The Glidden Company
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900 Union Commerce Building • Cleveland 14, Ohio
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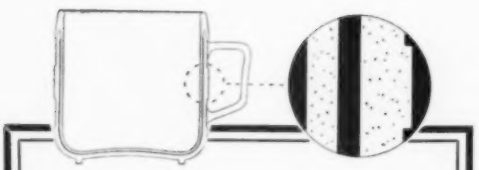
There's a GLIDPOL Polyester Resin system, plus Glidden Technical Service, to help you do it better, more economically, whatever your product, process or problem.

HEAT RESISTANCE...

...another way high-density polyethylene IMPROVES YOUR PRODUCT



Cutaway showing construction of Cornish Therm-O-Coffee cup. Insulation space permits comfortable handling regardless of temperature of the contents. Molded by Bopp-Decker Plastics Company, Clawson, Mich. for Proven Products Corp., Skokie, Ill.

TYPICAL PROPERTIES OF DMD-6201

	ASTM Test	
Density, gm/cc	D 792-50(A)	.950
Melt Index, gm/10 min.	D 1238-57T	8.0
No-Load Heat Distortion Temperature		128°C (262°F)
Secant Modulus (Stiffness), psi	D 638-58T	100,000
Tensile Strength, psi	D 638-58T	3300
Ultimate Elongation, %	D 638-58T	45
Tensile Impact (ft. lbs./cu. in.)		50

All physical tests conducted on samples with no orientation.

SCALDING DISHWASHER TEMPERATURES are no problem for BAKELITE Brand high-density polyethylenes. The material used in these cups—injection molded DMD-6201—stands up to dishwasher treatment day in and day out without losing shape or appearance. In actual tests, BAKELITE Brand high-density polyethylenes withstood both boiling water and steam sterilization.

Heat resistance is just one advantage of BAKELITE Brand high-density polyethylenes. You can select from formulations that emphasize strength, rigidity, surface appearance, stress cracking resistance, dimensional stability, and moldability in varying combinations.

In fact, you can select from a complete range of polyethylenes at Union Carbide Plastics Company... Extending through low, medium, and high densities, the choice also includes the remarkable new polyethylene copolymers. These copolymers possess the outstanding advantages of low temperature toughness, stress cracking resistance and unparalleled flex life. The same knowledge and experience that developed these materials is available to help you in using them to improve your product. Mail the coupon today, or write a description of your requirements directly to Dept. BQ-60G, Union Carbide Plastics Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada*, Union Carbide Canada Limited, Toronto 7.

BAKELITE and UNION CARBIDE are registered trade-marks of Union Carbide Corporation.

UNION CARBIDE

Even boiling water and steam sterilization failed to damage these cups made of BAKELITE Brand high-density polyethylene.

Dept. BQ-60G
Union Carbide Plastics Company
Division of Union Carbide Corporation
30 East 42nd Street, New York 17, N. Y.

Please send me information on BAKELITE Brand high-density polyethylenes with particular emphasis on these properties.....

the application being considered is .....

Name_____

Firm name_____

Street_____

City_____ State_____

Application for vinyls plasticized with PARAPLEX G-62

Add longer life to your vinyl products

PARAPLEX G-62 adds life to your vinyl products in many ways. First, this high-molecular-weight epoxy plasticizer improves stability to heat and light, even when used in small quantities. With increased amounts, you reap even greater benefits . . . heat and light stability rise linearly with PARAPLEX G-62 concentration—especially the resistance to heat degradation, which climbs along a straight line even when the level of PARAPLEX G-62 approaches 50 percent of the total plasticizer content.

Among commercially-available polymeric epoxides, PARAPLEX G-62 shows superior compatibility retention. This is particularly important when service conditions require exposure to direct or subdued light. Furthermore, when used in vinyl compounds, PARAPLEX G-62 has the essential permanence characteristics of very low volatility, and resistance to 1) extraction by soapy water and detergent solutions, 2) extraction by oil, and 3) migration into nitrocellulose, polystyrene, varnish, and baked enamels. PARAPLEX G-62 gives you both stabilization and plasticization at one low price.

Get more information on PARAPLEX G-62 and other Rohm & Haas plasticizers by writing for our 13-page booklet *What You Should Know About* PARAPLEX *and* MONOPLEX *Plasticizers.*

Chemicals for Industry

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

PARAPLEX *is a trademark Reg. U.S. Pat. Off. and in principal foreign countries.*

PARAPLEX G-62

FEBRUARY, 1960

PLASTICS
THE MAGAZINE OF APPLIED ENGINEERING
TECHNOLOGY

EDITORIAL:

1960 Plastics Processing Machines—Part I

In this issue, we are proud and pleased to present the first of three special issues planned for this year, dealing with various categories of plastics processing machines and auxiliary equipment. Parts II and III will be published in May and September.

Part I in this issue can actually be subdivided into two sections; 1960 Thermoforming Machines, and 1960 Compression and/or Transfer Molding Machines & Auxiliary Equipment. Part II, in May, will deal with 1960 Injection Molding Machines, while Part III, in September, will cover 1960 Extrusion Machines and 1960 Blow-Molding Machines.

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Following the system established and used so successfully by this publication in the past, the first section in this issue begins with a thought-provoking article on "What a Plastics Engineer Should Look For When Planning to Buy a Thermoforming Machine," written by Walter Ronayne, Sales Development Engineer for Celanese Plastics Co. Following this introductory article is a tabulation, PT's Comparative Data on 1960 Thermoforming Machines.

Similarly, the second section begins with an introductory article on "What a Plastics Engineer Should Look For When Planning to Buy Auxiliary Equipment for Compression and/or Transfer Molding," written by Edward Vaill, Technical Service Engineer for Union Carbide Plastics Co. (In many ways, this article can be considered an elaboration and continuation of Frank Donohue's article in our February, 1959 issue on "What a Plastics Engineer Should Look For When Planning to Buy a Compression or Transfer Press.") This article is followed by PT's Comparative Data on 1960 Compression and/or Transfer Molding Machines.

Wrapping together the two sections in this issue is a lengthy and detailed listing, PT's Classified List of Auxiliary Equipment for Thermoforming and Compression and/or Transfer Molding.

An interesting sidelight to this and previous special machinery issues are their effects in promoting and hastening standardization of specification data by the machinery manufacturers. This is an added extra in addition to the obvious values of the listings and comparative tabulations to both our readers and the machinery makers/suppliers. In particular, the tabulations offer comparative data by which the reader can quickly assay and compare the various machines available in this country and select the one that best fits his needs.

The thermoforming machines category is new for this publication, and displays rather obviously the need for increased standardization. As with the older (to us) machine categories that began their publication life in this magazine in 1958, the next time around should show definite improvements in standardization of machine specifications.

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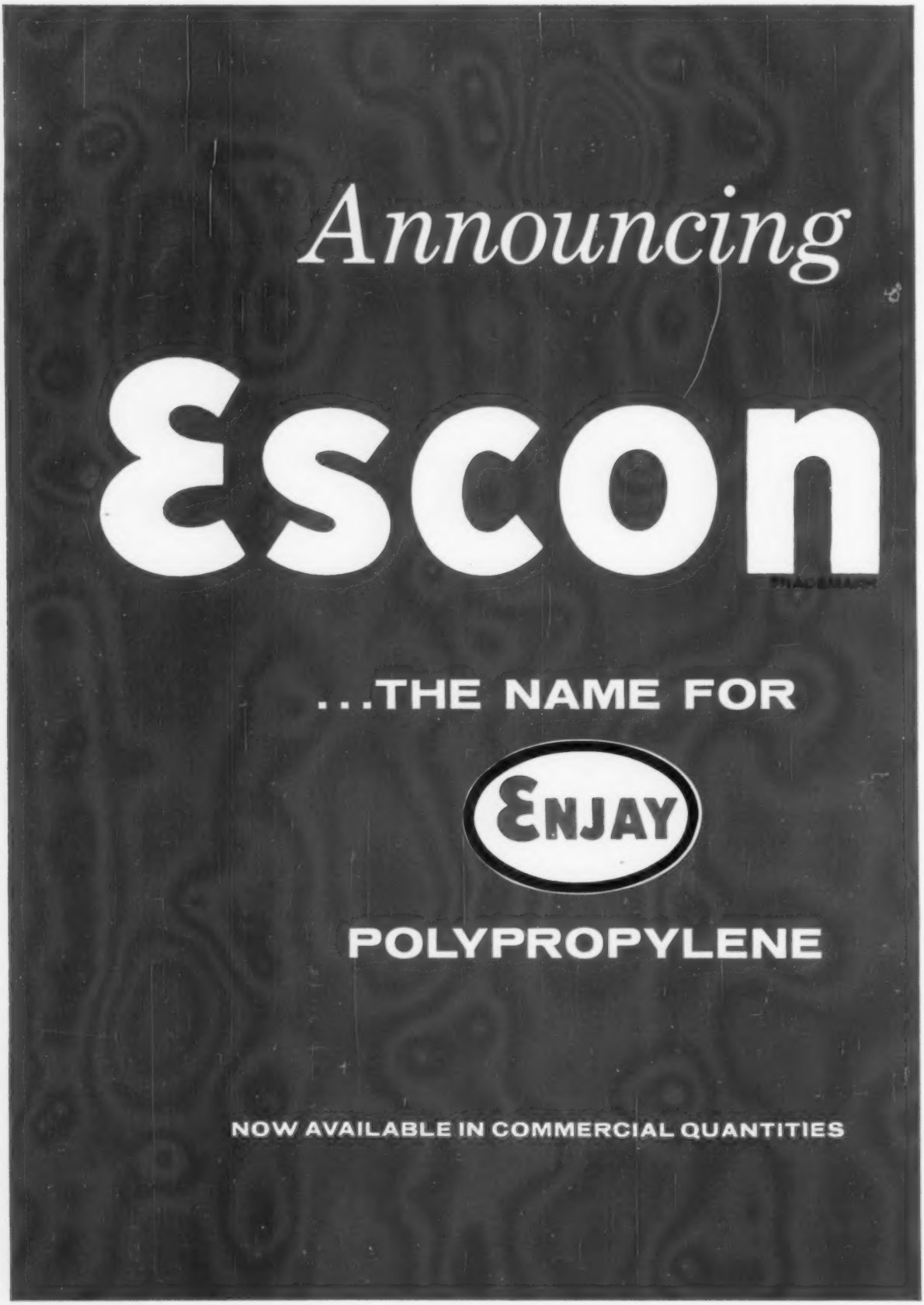
So there it is, our 1960 special section — Part I. Your comments are invited!

Arthur M. Merrill
Editor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Escon
TRADEMARK
...THE NAME FOR
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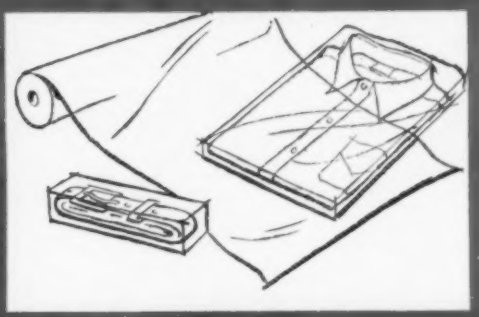

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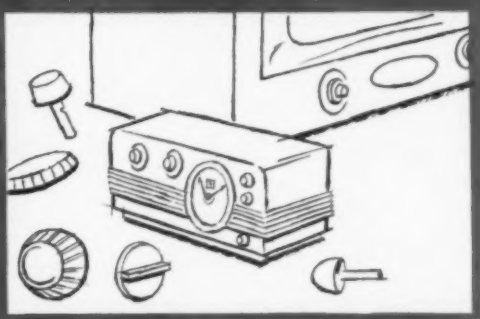

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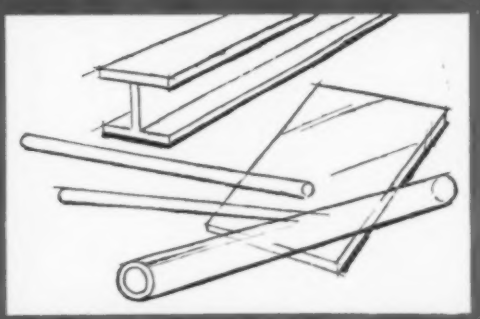

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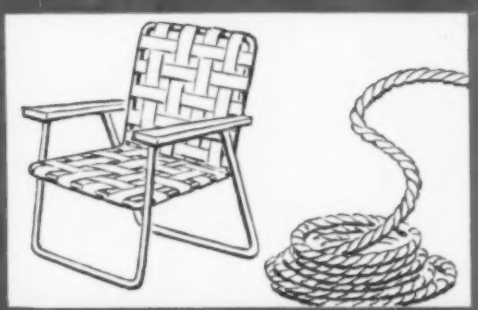

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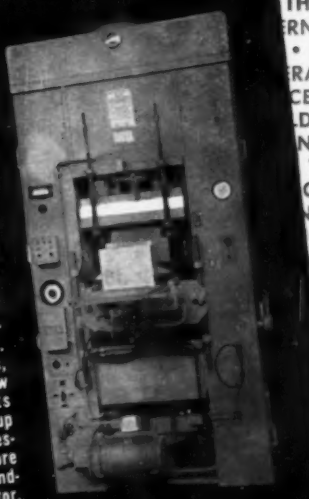

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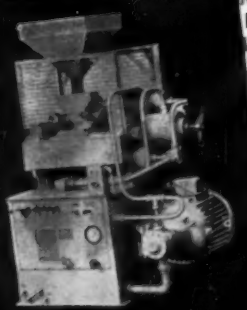

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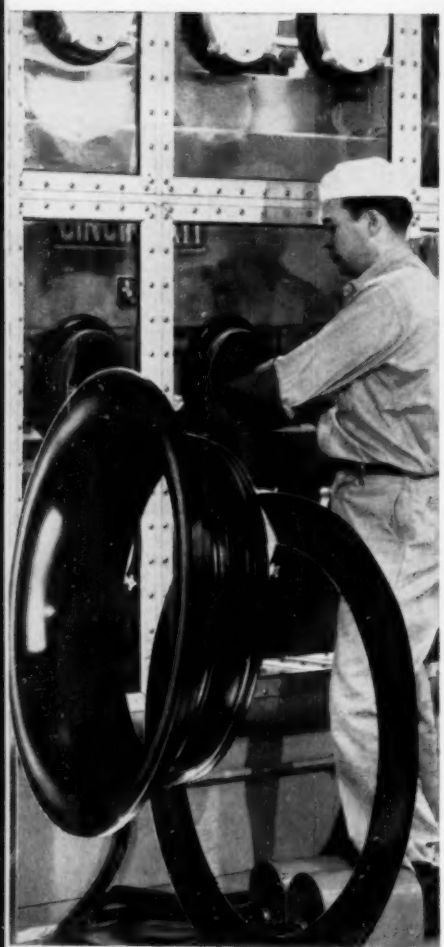

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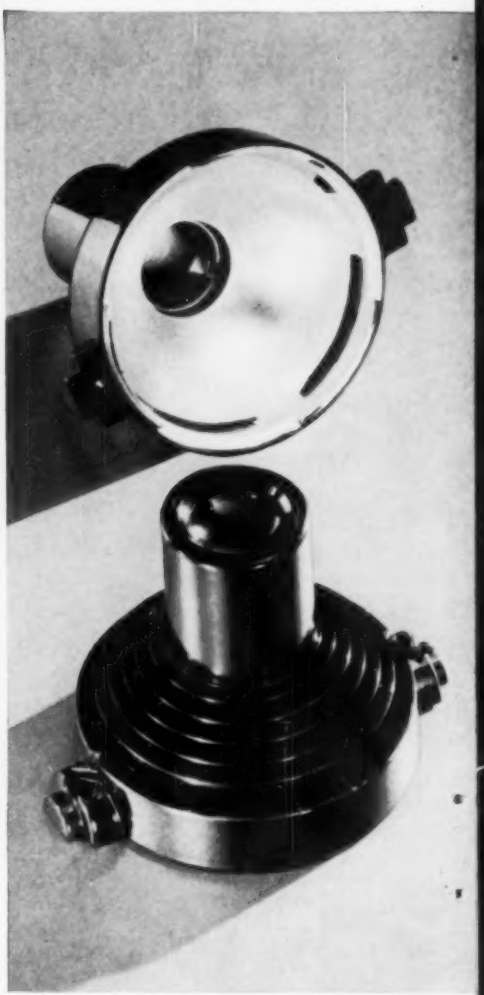

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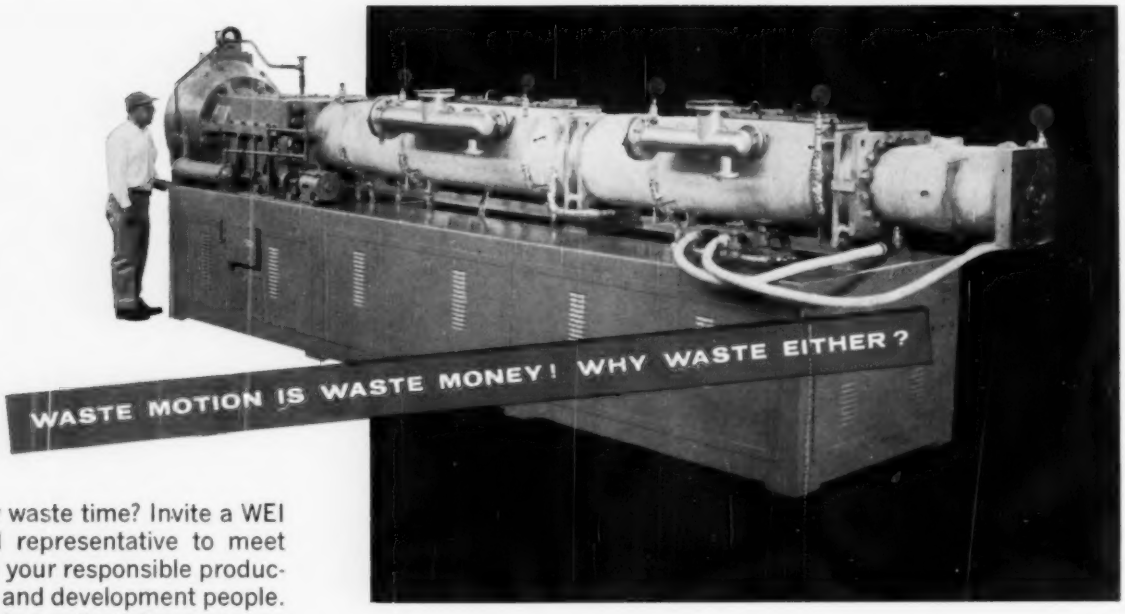

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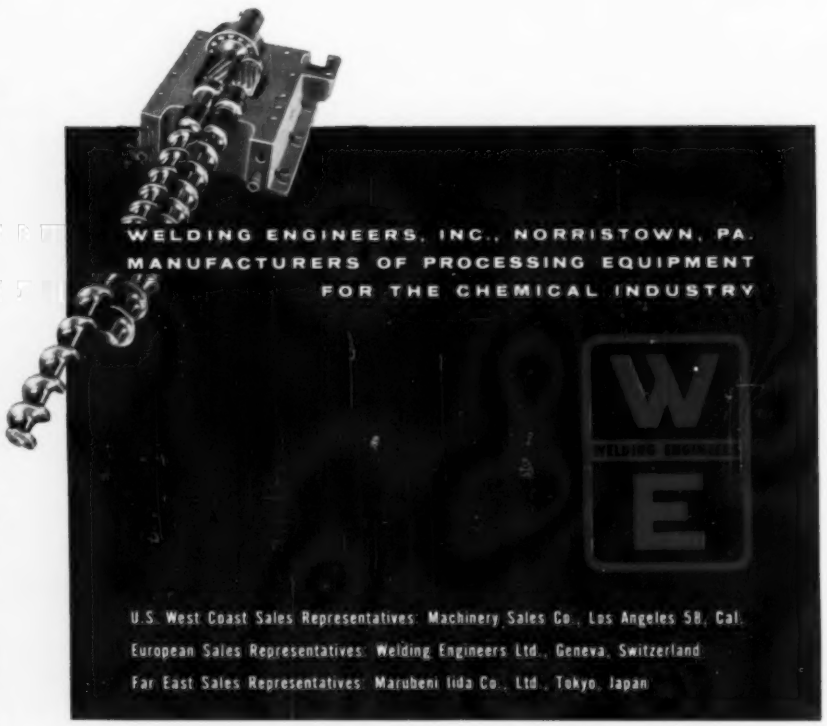
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PLASTICS
THE MAGAZINE OF APPLIED ENGINEERING
TECHNOLOGY

Significant Flow Properties of Thermoplastics

How processing behavior can be predicted from viscosity-shear rate-temperature curves.

L. B. RYDER, Sr. Research Engr.
Plastics Research Dept.,
Summit Research Laboratories,
Celanese Plastics Co.
Summit, N. J.

THE standard methods now used for measuring flow properties of thermoplastics are intended primarily for control during the manufacturing process and for identification of the final product. For these purposes, the tests conducted at standard temperatures and standard rates of shear and stress usually are sufficient. However, experience has shown that these standard flow data are insufficient for predicting the flow behavior of plastics under actual processing conditions. Since most thermoplastics are non-Newtonian fluids, their viscosity will depend on temperature and applied shear stress or rate of shear. Data which are to be meaningful to the processor must be obtained in the range of temperatures and at the rates of shear and stress prevailing in the actual processing.

This paper presents viscosity-shear rate-temperature curves for cellulose acetate, cellulose propionate, and linear polyethylene molding powders, and shows their use in explaining or predicting extrusion or molding behavior.

An example is given to illustrate the confusion which can result when trying to correlate one measure of fluidity (such as melt index) with polymer fabricability. A simple method is given to avoid this confusion.

Data for determining the apparent viscosities of thermoplastics were obtained with an orifice-type extrusion plastometer. The apparatus consists of a vertically supported stainless steel cylinder with an 0.5-inch bore (see Figure 1). The cylinder is equipped with surface-mounted precision heaters, thermostated for temperature control. The top of the cylinder is fitted with a high-pressure gas connection. A head plate is attached to the bottom to hold the orifice dies in place.

The plastic is extruded by applying nitrogen gas pressure above a small, close-fitting, stainless steel ram placed in the bore between the plastic melt and the incoming gas. High- and low-range pressure gages are installed in the supply line to indicate the pressure applied to the melt. Suitable valving is provided to permit varying the pressure from 0-2,000 psig. Four different orifice dies were used in this study, each having a diameter of

In its original form, this paper was presented at the 15th ANTEC, Society of Plastics Engineers, Inc.

Leonard B. Ryder was born in Rhode Island in 1925. His college career was started in 1942, but interrupted by a stretch of three years in the Navy. Returning to civilian life after the War, he received a B.S. in Chemical Engineering in 1948, and an M.S. in Chemical Engineering in 1952 from the Newark College of Engineering. From 1948-1952, he worked for the Finishes Division of Interchemical Corp. on the development of resins and coatings for metal decorating, and progressed through various assignments in process, project, and staff engineering. He has been with Celanese since 1952, starting as a member of the Technical Liaison Section of Central Engineering. He transferred to the Plastics Division in 1952, working in operations analysis and process and development engineering where he did fundamental studies in extrusion and rheology of plastics. Since January 1959, he has been with the company's Plastics Research Department in the Summit Research Laboratories.

Mr. & Mrs. Ryder have two children, and make their home in Whippany, N. J.

0.02-inch and land lengths of 1/16-, 3/16-, 3/8-, and 3/4-inch respectively. Figure 2 is a photograph of the complete assembly.

Test Procedure

The desired orifice die was bolted to the bottom of the plastometer cylinder, the thermoregulator set, and the unit heated to the desired temperature. About 10 grams of the sample then were charged into the cylinder through a funnel. (The cellulose acetate and cellulose propionate molding powders were pre-dried before charging). While being charged, each sample was tamped with a metal piston to prevent the formation of air bubbles. The stainless steel ram then was inserted into the bore on top of the sample and the gas connection bolted in place.

A 10-minute heating period was allowed for the sample to come to temperature. At the end of this period, a slight pressure was applied and the melt extruded for about three minutes to reach equilibrium. The pressure then was raised to the desired level and the extrudate cut off at the orifice and discarded, preparatory to taking samples. Extrusion was continued and the extrudate cut off after a measured period of time.

A minimum of four samples were taken at each pressure level and weighed later on an analytical balance. A record was kept of the applied pressure, melt temperature, average sample weight, and extrusion time. This procedure was repeated for each orifice die and temperature.

Viscosity data were obtained for the following molding powders:

(1) Cellulose acetate (XM-MH)—General purpose medium-hard flow grade. ASTM flow = 150±5° C.

(2). Cellulose propionate (JMB-M)—General purpose medium flow grade. Equivalent ASTM flow = 164.5° C.

(3). Linear polyethylene (Fortiflex A-70) = a high-density polyethylene of 0.7 melt index.

Data Reduction

To determine the apparent viscosity as a function of shear rate, the following procedure was used:

(1). Calculate the flow rate in grams per second for each condition and convert to volumetric units using the density-temperature plot in Figure 3. Melt densities were determined at low pressure (less than 50 psi.) using a melt index machine (1)*. Pressure is believed to have little effect on melt density (2).

(2). On the same graph, plot volumetric flow rate versus pressure gage reading for each of the dies.

(3). Gross-plot pressure gage reading versus orifice land length using flow rates as parameters. Extrapolate the flow rate lines to zero land length to obtain the pressure correction. (This includes melt chamber and entrance losses.)

(4). Subtract the pressure correction from the pressure gage reading to find the orifice pressure drop (ΔP) for each flow rate.

(5). At each flow rate, calculate the shear rate and shear stress for each orifice die. Compute the average

* Numbers in parentheses refer to Bibliography at end of article.

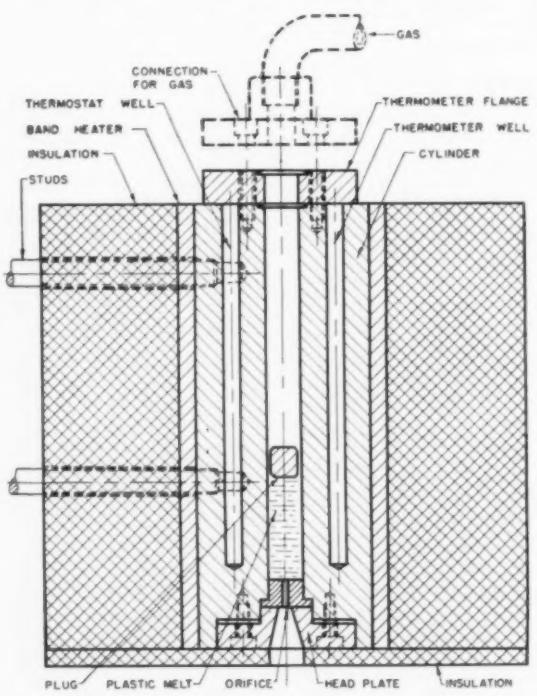

Fig. 1. Cross-sectional diagram of extrusion Plastometer.

shear stress for all the dies used.

(6). Calculate the apparent viscosity at each shear rate, and use average shear stress corresponding to each shear rate.

(7). Plot apparent viscosity versus shear rate for each temperature level.

This procedure was followed for each resin, at three temperature levels. The viscosity-shear rate-temperature curves obtained are shown in Figures 4, 5, and 6.

Significance

A great deal can be learned about the flow properties of a material by examining its viscosity-shear rate-temperature plot. Let us examine a plot for cellulose acetate which appears in Figure 4. At all temperature levels, the viscosity of the material decreases rapidly with an increase in shear rate. Gradually, as the shear rate increases, the shear dependence of viscosity decreases. It can be seen that, at shear rates above 800 sec.—1, the material is fairly insensitive to shear rate changes. We also see that, in this case, increasing the resin temperature will cause the viscosity of the material to become somewhat less shear-dependent. The graph also shows that the viscosity is more temperature sensitive at low shear rates than at high shear rates. This relationship will be discussed later in more detail.

Figure 7 shows how the fluidity of the three resins compare over a wide range of shear rates. Linear polyethylene is seen to be the most viscous of the three, followed by cellulose acetate. At shear rates of 700 sec.$^{-1}$ and above, the cellulosics have exactly the same flow properties.

A question which naturally comes to mind is, "What

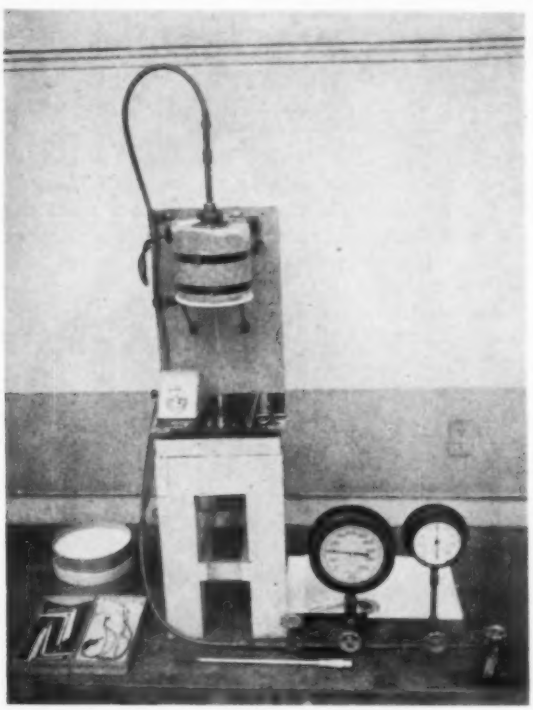

Fig. 2. Extrusion Plastometer and assembly.

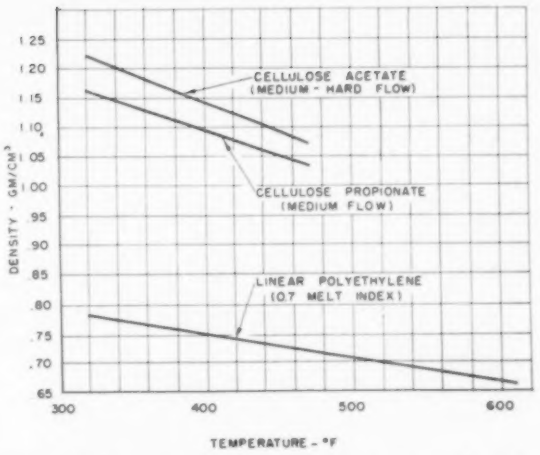

Fig. 3. Effect of temperature on melt density properties for three thermoplastics.

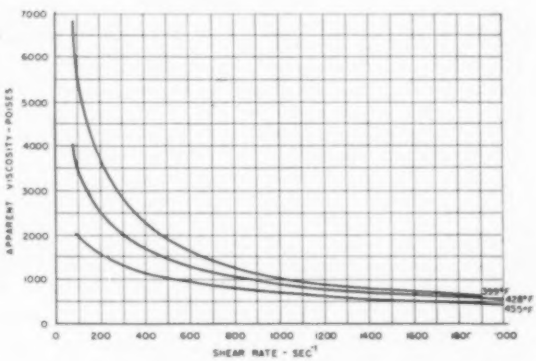

Fig. 4. Effect of apparent viscosity on shear rate for cellulose acetate resin (medium-hard flow).

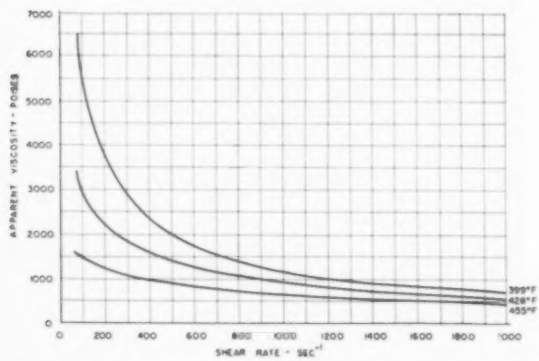

Fig. 5. Effect of apparent viscosity on shear rate for cellulose propionate resin (medium flow).

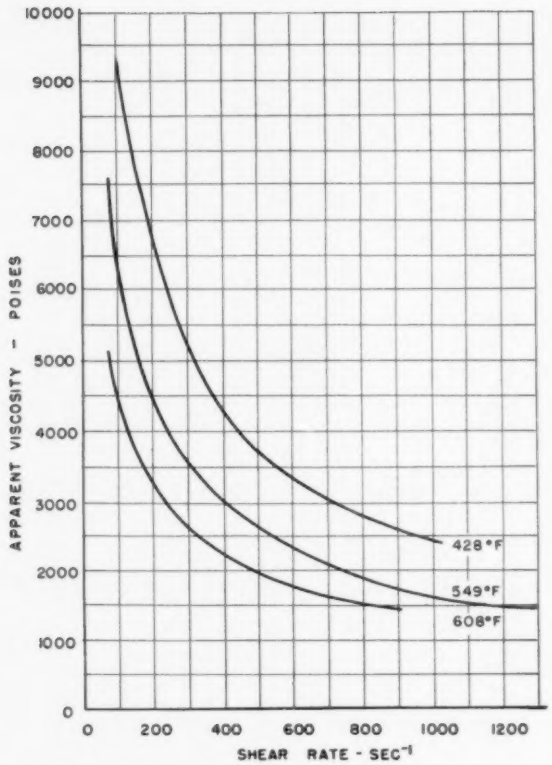

Fig. 6. Effect of apparent viscosity on shear rate for linear polyethylene (0.7 melt index).

practical applications would an analysis of this type have?"

Suppose it is desired to extrude cellulose acetate film with close dimensional tolerances. We know that dimensional uniformity will depend, among other things, upon the steadiness of flow or output from the extruder. Since the flow is dependent upon viscosity, any changes in viscosity will naturally cause changes in flow. Referring to Figure 4, we see that smaller variations in output are likely to occur as a result of viscosity changes if the equipment is operated in the high shear rate range. Above 800 sec.$^{-1}$, the viscosity will be fairly insensitive to temperature or shear rate changes. There will be many instances where it is impractical or impossible to operate at high shear rates. In cases like this, the material should be extruded at high temperatures since the higher the temperature, the lower the shear dependence of viscosity.

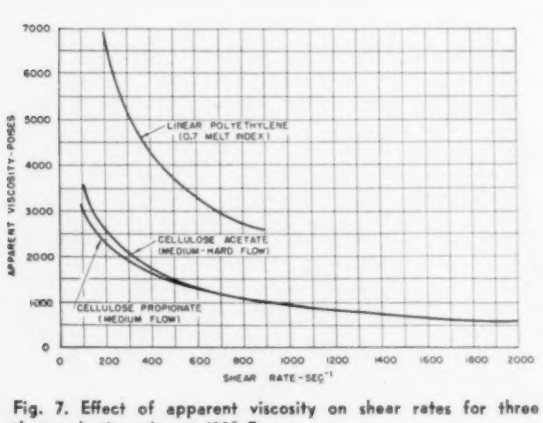
APPARENT VISCOSITY - POISES
SHEAR RATE - SEC⁻¹
LINEAR POLYETHYLENE (0.7 MELT INDEX)
CELLULOSE ACETATE (MEDIUM - HARD FLOW)
CELLULOSE PROPIONATE (MEDIUM FLOW)

Fig. 7. Effect of apparent viscosity on shear rates for three thermoplastic resins at 428° F.

A melt temperature of 475° F. frequently is used in the extrusion of cellulose acetate film (1-2 mils). Typical shear rates in the die range from 450-570 sec^{-1}. Figure 4 shows that this corresponds to operating in a region where the viscosity is fairly insensitive to changes in temperature and shear.

Another example can be given to show the usefulness of the viscosity-shear rate-temperature curves. Suppose resins "A" and "B" have been developed as potential replacements for another resin which is used in the manufacture of a textile yarn. Assume three critical points exist in the process pipe line pumping, filtration, and jet spinning, where resins have failed for lack of sufficient fluidity. A simple screening test must be made to determine whether the new resins would perform well in the process.

The first step is to determine the shear rate or stress which prevails at each of the critical points. Next, the viscosity of each resin is determined at these shear levels and then compared with the control. Then, by comparing the plotted shear rate—apparent viscosity curves, we see that neither resin would be satisfactory as a replacement for the control without making changes in the conditions at critical processing stages.

Simple Test Method

Melt index (1,3) is a convenient value often used to characterize polyethylene resins. It is a measure of melt flow at a particular set of conditions (temperature and shear stress). Since the fluidity of a material can change considerably with temperature and shear rate (or stress), it is not surprising that the melt index finds only limited use in predicting how a resin will process commercially. This is particularly true for injection molding where the shear stresses in certain critical sections often are in the order of 5-10 times that used in the melt index test.

The extrusion and molding behavior of a resin can be understood and predicted by analyzing its viscosity-shear rate-temperature curves. In cases where these curves are not available, a very rapid flow characterization can be made using a standard melt index machine. The only additional equipment needed is a thermoregulator and a set of piston weights for testing over a range of temperatures and shear stresses. The material is tested by selecting the desired temperature, and measuring the flow rate at different piston loadings. The flow behavior can then be evaluated from a plot of flow rate versus applied load.

Two experimental linear polyethylene resins of identical melt index (0.6 MI) were recently tested by this method. In this case, both resins were made by the same process, in the same type equipment, but in different plants. The plot shows that although the melt indexes of two resins are identical, the fluidity of the two resins can differ considerably at high shear stresses. This was confirmed by the results obtained on two other linear polyethylene resins, both having an 0.7

melt index. One was made in production and the other in experimental equipment. They were found to have an even greater difference in fluidity at the high shear stresses. In this case, as predictable by the test, the resin with the higher fluidity injection molded well; the other, poorly.

Effect on Polymer Flow

The temperature coefficient of viscosity (b) was obtained by plotting the log of the viscosity versus temperature, measuring the slope (m), and substituting in the following equation: $b = -2.3\ m$.

This procedure was repeated for each resin at several different shear rates, and the results are plotted in Figure 8. The plot shows that of the resins tested, cellulose propionate is the most sensitive to temperature change (has the highest temperature coefficient of viscosity), and polyethylene is the least sensitive. It is interesting to note that the temperature coefficient of viscosity was found to vary with shear rate; decreasing with increasing shear rate until it reaches some limiting value. This effect was very pronounced with the cellulose esters, and less so with polyethylene. It is well to point out that these results do not agree with the general conclusion that the temperature coefficient of viscosity for thermoplastics is independent of shear rate.

One can determine the relative temperature sensitivity of viscosity of several thermoplastics from the values listed in Table 1. An attempt was made to list the resins in the order of increasing viscosity sensitivity to temperature change.

Table 1. Relative Temperature Sensitivity of Viscosity of Several Thermoplastics.

	Temperature Coefficient of Viscosity, ° F.$^{-1}$
High-pressure polyethylene*	0.0032
Linear polyethylene	0.0033-0.0046
Styrene-acrylonitrile*	0.0036
Polystyrene*	0.0046
Cellulose acetate	0.0024-0.0061
Cellulose propionate	0.0025-0.0086
Vinyl chloride*	0.015
Cellulose acetate butyrate*	0.019

* From data reported by R. D. Sackett in paper, "Viscosity Data for Extruder Flow Equations," presented at SPE 12th ANTEC, 1956.

Conclusions

Examples have shown how the processing behavior of thermoplastics can be understood or predicted by analyzing their viscosity-shear rate-temperature curves. When these curves are not available, a very rapid flow characterization can be made by measuring flow rate through a melt index machine at different piston loadings.

The temperature coefficient of viscosity was determined for each resin tested, and compared with the values for several other thermoplastics. This study showed that the coefficients of cellulose acetate and cellulose propionate depend on shear rate.

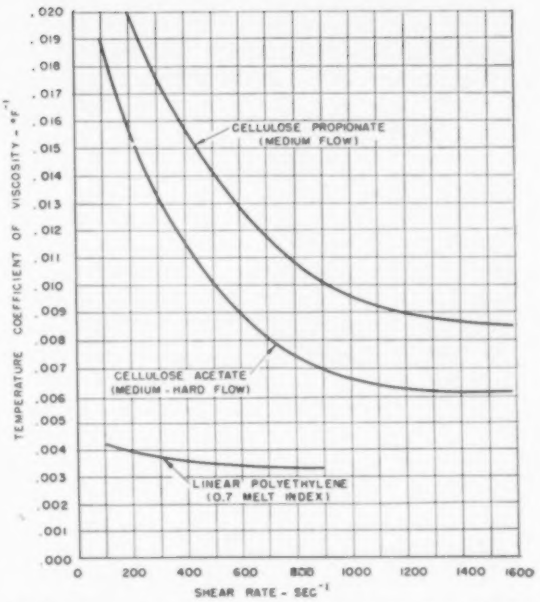

Fig. 8. Temperature coefficient of viscosity versus shear rate for three thermoplastic resins.

Acknowledgments

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Bibliography

(1). Tordella, J. P., and Jolly, R. E., "Melt Flow of Polyethylene," **Modern Plastics**, 146-150, 229 (October 1953).

(2). Westover, R. F., and Maxwell, B., "An Investigation of the Flow Behavior of Polyethylene," Princeton University Plastics Laboratory Technical Report 27-A, 14 (October 1952).

(3). "Tentative Method of Test for Measuring Flow Rates of Thermoplastics by Extrusion Plastometer," ASTM Designation: D1238-57T.

—THE END

Bas-relief map of the Niagara Falls area molded of polyester resin reinforced with Owens-Corning Fiberglas. Scaled one inch to every 125 feet, the map was molded in 12 sections and measures 20 by 30 feet. It was designed for the Power Authority of New York by Lester Associates, and affords the same view an airplane pilot would get at 8,000 feet.

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What a Plastics Engineer Should Look for When Planning to Buy a Thermoforming Machine

THE main purpose of this article is to offer a series of guide-posts which will be of assistance in determining what kind of thermoforming equipment best suits your needs, especially those of you who have little or no experience in this field. No attempt will be made here to discuss these machines in technical detail. This is best left to the machine manufacturers themselves. A handy chart follows this article which lists the machine manufacturers and gives basic data about each of their models and types.

The determining factor in buying thermoforming equipment is knowing what you want to produce. Thermoforming equipment has become increasingly specialized in the past five years. Prior to that time, most machines were of the "general-purpose" type, and were used to form a wide variety of products and packages for short- or medium-production runs. However, due to a tremendous upsurge in demand for thermoformed products and packages and a wider variety of thermoplastic sheet materials available, special machines and machine attachments have been developed.

Since you now have the opportunity to choose from a wide variety of models and types, you should ask yourself the following questions: "What field am I particularly interested in; packaging, industrial products, display, development, or toys and novelties?" "What kind of production rates will I require?" "What type of materials will I be forming?" These questions should be pretty well settled in your mind before shopping for equipment, because this will save a lot of time and effort in selecting equipment to meet your requirements.

Thermoforming Machines

Because there is no universal thermoforming machine (and very little likelihood of any being developed), machine manufacturers have built a variety of models to choose from. These include laboratory models, general-purpose machines, industrial machines, packaging machines, and pressure-forming machines. Laboratory models are used for testing materials and developing prototypes. The general-purpose or so-called "workhorse" models offer a wide range of forming techniques for a variety of products. Another group of machines, the industrial types, offer extra-rugged construction and large forming areas. A more recent entry into the thermoforming field is the integrated packaging machine which automatically forms material from roll stock, die cuts or slits sheets after forming, fills the formed container, heat-seals a coated card or film

to them, and ejects the finished packages.

If skin packaging is your main interest, there are machines especially made for this purpose which may be run manually or semi-automatically. Complete automation also is possible, but skin packaging has not reached this stage as yet. It should be kept in mind that most general-purpose machines can be used for skin packaging and, likewise, many skin-packaging machines can produce blisters and other formed parts.

Another category of thermoforming equipment which has been developed recently is what is generally known as "pressure-forming" machines. Most of the pressure-forming machines that are available commercially today use what is known as the "trapped sheet" technique. This means that the sheet is fed into the machine (which basically is a press similar to a compression molding press), the platen closes over the sheet, and the sheet is blown against a heater plate which is on the top platen directly above the mold. When the sheet attains proper forming temperature, the air pressure is reversed and the heated sheet, which has been "trapped" between the platens, is blown down into a female mold. These machines are of particular advantage to those who wish to form such materials as biaxially-oriented styrene and polyester sheets. However, these machines can be adjusted to accommodate most of the thermoplastic sheet materials now on the market.

Material Considerations

Cellulose acetate, cellulose butyrate, oriented styrene, impact styrene, styrene alloys, polyolefins, vinyls, and acrylics are the most commonly-used sheet materials. All of these materials have their own forming characteristics. Your problem in selecting equipment becomes increasingly difficult the more of the above-mentioned materials you wish to form in one machine. Comparatively new materials, such as oriented styrene and high-density polyethylene, require a different approach, most noticeably in clamping and heating the sheet.

Another consideration to keep in mind is the adaptability of stock-roll widths available from material suppliers. Stock-sheet sizes also should be considered; however, most thermoforming in gages up to 0.030-inch is done from roll stock. Sheet sizes are more important for industrial applications where gages from 0.060-inch and up are used. A check also should be made to see that there is sufficient room on the machine to use the maximum-diameter roll available. If changing rolls after one has been used up presents a problem, it might well be a good idea to have a machine provided with a place to put a second roll so that as one runs out, the second roll can be spliced onto it. This overcomes the necessity of stopping the machine in order to feed the new roll.

Most machines made today are geared to handle stock rolls and sheets, since most machinery manufacturers have checked with material suppliers before determining the size of their machines. In any event, if your volume requirement is high, material can be slit to any width within the limitations of the machine without additional cost.

Basic Machine Parts

Basic machine parts include platens, clamps, heaters, controls, and attachments.

Platens

In general, there are two types of platens; the stationary type, and the rising-platen type. Most manufacturers make both types, although the rising platen has become more popular and, in some instances, gives better results and the opportunity to use a more varied range of forming techniques. The platen also should be cored for water cooling, especially if long, continual runs are anticipated. A water-cooled platen, however, is not the complete answer to cooling problems. The most efficient method still is to cool the mold itself by either coring or embedding metal tubing in it so that water can be run in and out of the mold.

Clamps

The maximum inside dimension of the clamp, with some allowance for clearance, determines the largest part or multiple of parts that can be formed on the machine. The machine must have sufficient clamping pressure to hold the material securely during any forming technique. A clamp that can be adjusted in either one or two directions is highly desirable. This will allow you to make more varied layouts for multiple-part molds where you may not wish to use the maximum capacity of the machine. It will also enable you to use sheets cut-to-size for larger parts with a minimum of waste.

Heaters

Many people ask which type of heater is best for thermoforming? Actually, there is no "best type" of heater. All the various types used today provide a satisfactory source of heat. What is important, however, is the density of the heater and the distribution of heat to the sheet. Heater density is the ratio of electrical power input (in kilowatts) to the heater, to the total area (in square feet) of the heater bank. Materials such as acetate, impact styrene, or vinyl do not require the density needed by high-density polyethylene.

It is a good idea to have the machine equipped with a high-density heater because the way the plastic field is moving today, new materials are just around the corner which may require even higher heats. Because of higher heat requirements, the "sandwich heater" was born. This type of heater makes it possible to heat the sheet from both sides at the same time. This is a big advantage when working with heavy-gage materials of any type. Individual operation and control of a "sandwich heater" also are important. It should be kept in mind that it is a lot easier to cut down the heat for those materials not requiring high heat than it is to run a heater at full capacity (which will wear it out faster and speed up the forming cycle).

Controls

Manual and automatic controls for heat, cycling, vacuum and/or air pressure, and material feeding

become increasingly important as the degree of precision required increases. Although, in many cases, thermoforming is essentially an "art", the only way it can become more scientific is with high-quality controls for all machine components. Good controls pay for themselves by materially cutting down on rejects and inconsistency in formed parts.

Attachments

PLUG ASSISTS. The plug assist is of particular help in distributing material more evenly when running a female mold that is more than one-half the depth of the smallest dimension across the cavity. In some cases, assist attachments come as part of the basic machine, are added in others. Your immediate needs may not require an assist attachment; however, it would be a good idea to check if one could be added at a later date without expensive revamping of the machine. The female mold-plug assist combination usually permits a greater number of parts to be made per cycle on a given area, in comparison with male molds. This becomes a very important factor in long runs where materials savings will far outweigh the added mold costs.

AIR ASSISTS. An air assist is used mainly in the industrial forming field where heavy-gage sheets are involved. Here, again, its main benefit is in distributing the material more evenly than with conventional drape forming, especially on deep draws. In most cases, it also cuts down on the size of the sheet needed to form an acceptable part. Most of the equipment offering this feature has it "built-in" as a basic part of the machine. Many machines cannot be converted to utilize this technique. As a substitute, however, the "snap back" technique can be used.

To utilize this technique, the machine must be equipped with a movable top platen, like a plug-assist attachment. Instead of putting a plug assist on the top platen, the actual mold is attached; on the bottom platen, a vacuum box is attached and remains stationary. The material is clamped to the vacuum box and heated; a controlled vacuum is applied; and an inverted "bubble" is formed to the size required. The mold on the top platen descends into the bubble and, as the top platen clamps against the sheet, a vacuum is pulled up around the mold. The result is similar to "air bubble" assists.

MATERIAL FEEDS. Basically, material is fed into the machine in cut-to-size sheets or from rolls. Sheets are fed manually, and rolls either manually or automatically. Manual sheet and roll feeds are a basic part of many machines; but with automatic roll feeds, it is a feature which can be added. Automatic roll feeds are best used in forming thin-gage sheet where cycles are short and it would be difficult for an operator to remove and trim parts while keeping up with the forming cycle. It also gives the operator more time to concentrate on checking cycles, heat, etc.

Other Considerations

Machine Limitations

In addition to the limitation of the size sheet which can be formed, there are limits on each machine for the depth of draw on both male and female molds. Unless your requirements are specialized and you can foresee your maximum requirements in this area, it is best to get the greatest depth limitation available. This is particularly true in the industrial forming field. (Note these limitations on the Comparative Data tabulation.)

Cutting

Cutting parts from the web of material after it is formed is accomplished by three basic methods: die cutting; blanking; and slitting. This particular phase of the thermoforming process has lagged behind technically as compared to the actual forming process. Very few machines have the cutting operation as an integral part of the machine. Most cutting is done as a separate operation, although recently many machines have been hooked up to an automatic or manual in-line die cutting operation.

Blanking is the least used method of cutting. (Blanking may be compared to the operation of a ticket punch.) Because of the high die cost, it can be justified only where the production is high and exceptionally clean-cut edges are required. Slitting is a simple and high-speed method for cutting parts. This is done either with a right-angle slitter or a combination of slitting and chopping. The only disadvantage of this method is that you are limited to straight-line cutting, but this method is used very effectively in the packaging field for both "blister" production and skin packaging.

Trial Runs

After you have investigated the various types and makes of commercially-available equipment and have found one to fit your needs, the next step should be a trial run. This does not mean one or two sample formings, but rather a run that would approximate a production run. This is important especially where the equipment will be required to operate steadily for high-production jobs. It also means running all the materials which you contemplate using. This is where the material supplier should be brought into the picture, and you should arrange to get a sufficient amount of material of each type you wish to use. Most suppliers are willing to supply material against future orders, at the same cost as if it were bought in larger quantities, or on a no-charge basis, depending on quantity and future potential market. No reputable machine manufacturer will deny you a trial run which is to his advantage as well as to yours.

All machine manufacturers have some models of their standard equipment for demonstration purposes. They are used to show basic forming techniques and special features of their lines of equipment, but very few have models of each type ready for trial runs. The trial run should be done on the machine built for you in the manufacturer's plant. This will acquaint you with the machine's operation, and also serve as a short breaking-in period. Any minor "debugging" which may be required can be done in their plant. If possible, a production mold should be used to test the full capacity of the machine.

Plant Installation

Aside from adequate floor and head space and good anchorage of the machine to the floor, the two things which must be checked are electrical connections and compressed air requirements. It is sometimes best to tailor these to the forming machine, rather than to depend upon existing electrical and air lines which already may be overloaded. A steady and dependable flow of electricity and air is necessary for smooth and consistent operation of the equipment. Most machines have integral vacuum units, but many require auxiliary compressed air equipment.

Machine Field Service

The thermoforming equipment business is very competitive, and should become even more so in the near future. The manufacturers of thermoforming equipment know this, and have found that it is not enough just to build equipment which will perform satisfactorily when it is built. It is also necessary to offer adequate and fast field of servicing of machinery after it is installed in your plant. Good servicing arrangements usually are a good indication of the manufacturer's faith in his own machinery and the company's integrity. Good field service also is important because there is very little interchanging of parts and attachments from one manufacturer's equipment to another's. Therefore, you are pretty much dependent on them until you have become well acquainted with the machine and the thermoforming techniques it offers.

Conclusions

There are many methods by which thermoplastic sheet materials can be formed; more methods than any other means of producing plastics products, including extrusion, injection molding, and blow molding. Not so many years ago, emphasis was on the ease of thermoforming a sheet of plastic. This is still true to a certain extent, if your needs are simple, but thermoforming has come of age and has created more exacting demands and an increasingly-wide variety of products and packages to be produced. This, basically, is why we have more specialized machinery available today. The units are not only specialized as to thermoforming techniques, but also as to the field for which they are made (this includes a variety of packaging methods, general-purpose forming, or industrial forming).

Now, more than ever before, you should know just what you want to produce and with what plastic or plastics, before running all around the country "just looking." Check with the materials suppliers for technical data and sheet samples. Confide, as far as possible, with the machine manufacturers about your needs and the types of products you want to produce. Remember that no single machine can or should be expected to produce for every field, especially with all the plastics available today. Once you have decided on type and size of machine, you must design your parts within the limits of that machine, which includes basically the size of the part and the technique by which it can be formed.

Actually, the thermoforming field is too wide in scope to go into more detail about all the variables which would determine choice of equipment. What has been offered here will give you at least some basic perspective from which to proceed. To do justice to this field, thermoforming equipment should be broken down into categories sometime in the near future to include a discussion of general-purpose machinery and forming techniques, and be followed by a more detailed description of the expanding packaging and industrial forming fields. In this way, an even clearer picture can be offered which will make your choice of equipment easier and more intelligent. —THE END

PT's Comparative data on 1960

Thermoforming Machines

Manufacturer*	Abbott	Atlas Vac						Auto-Vac
Model number	33	Form-Er, A-14	Form-N-Seal	Pressure Form-Er	Pac 20	Form-Er H-18	2-71; J-36	MV 2-24
Forming method#	S-P, V-F	G-P, S-P	G-P, P-F	P-F	G-P, S-P	G-P, S-P	G-P, S-P	G-P
Type of Controls	Auto.	Manual or Auto.	Auto.	Auto.	Auto.	Manual, Auto.	Manual, Auto.	Auto.
Type of feed	Roll	Cut sheets or roll	Roll	Roll	Roll	Cut sheets	Cut sheets or roll.	Cut sheets
Forming area (LxW), min.-max., in.	30 x 30	14 x 14	To customers' specifications.	10x10, 20x20, 24x30	20x20, 30x30	15 x 18	25x25; 36x36, 36x42	30x50, 42x72, 48x72
Maximum depth of draw, inches	8	6	3	- - -	5	6	8;12 min.	24
Rate of advance (min.-max.), in./sec.	Adjustable	0.7-1.4	1/6 cycle (min.)	20 in 6 secs.,min.	20 or 30 in 10 secs.	- - -	25-50; 36-72 in 10 secs.	- - -
Vacuum system: Pump motor hp.	1/2	1/3	- - -	- - -	1/2	1/3	1/2;1	5
Working pressure (min.-max.) psia. inches	27 max.	26 hg.	- - -	- - -	26 hg.	26 hg.	26 hg.	28
Time to pump down to 3 psia., seconds	30	1/4	- - -	- - -	1/4	1/4	1/4	3½ @ 60 cfm.
Heating: Type	One side	One side	Contact or one side radiant	Contact	One side	One side	One side	2
Number of independent zones	3	Optional	- - -	- - -	Optional	Optional	Optional	- - -
Heater area (LxW), inches	36 x 36	19 x 19	To customers' specifications.	To fit forming area.	27 x 27	21 x 24	32 x 32, 42 x 42	52 x 76
Space between sheet & heater, min.-max., inches	0 - 12	3 - 12	- - -	- - -	3 - 12	3 - 12	3 - 12	4
Cooling, Type of	Air blowers	Fans	- - -	- - -	Fans	- - -	Fans	Blower
Ejection, Type of	Air	Auto.air blow-off	- - -	Auto.	Auto.air blow-off. →			Air
Special features	Two-stations	Self-contained. Available in 4 degrees of automation.	Low-cost tooling. Ease of set-up. No limitations on size & location of blisters. Thermostat-controlled from 0-600° F. Hydr. trimming.	One unit to form & trim auto. Quick change-over. Two individ. special hi-low pumping systems. Forming & trimming pressures adjustable.	Fully-automated form & trim unit that provides contour trimming. 25-ton hydr. press cutting mechanism. Special shuttle on heater for heat uniformity.	Lab.unit. Made in 2 styles: for manual operation, air controlled; auto. operation, timer controlled with manual heater & clamping.	Up-moving platen. 4-way adj. forming area. Continuous auto. production. 4-styles of automation.	Clam-action pneumatic clamp.
Optional features	- - -	15x15½ forming area. Water-cooling of platens. Double-opening frames for S-P.	Auto. loaders for filling blisters.	- - -	Water-cooling of platens. S-P with double moving shuttle that can be loaded from both sides.	Air supply included.	Larger forming area. Water cooling of platens. Overhead pressure.	Plug & vacuum for snap-back. Full circulation in lower & upper platens.
Approx. floor space (LxW), feet	3 x 12	2x4-1/3	- - -	9 x 3½	4 x 12	2-1/3 x 4-1/3	3-3/4x6; 5 x 10	6 x 8
Approx. delivery time, weeks	3	4 - 6	12 - 16	8 - 10	12 max.	4	6	10 - 12

* Complete company names and addresses are as follows:

Abbott Plastic Machine Corp., 7124 N. Clark St., Chicago 26, Ill.
Air-O-Flow Industries, Inc., 74 Varick St., New York 13, N. Y.##
Atlas Vac-Machine Corp., 1732 Hudson Ave., Rochester 17, N. Y.
Auto-Vac Co., 1984 State St. Extension, Bridgeport 6, Conn.
Borkland Mfg. Co., 803 Quarry Rd., Marion, Ind.##
Brown Machine Co., 110 Pierson St., Beaverton, Mich.
Comet Industries, 9865 Franklin Ave., Franklin Park, Ill.
Covema s.r.l., Italy (Sold by The Rainville Co., Inc., 657 Franklin Ave., Garden City, N. Y.##
Hahart Mfg. Co., Portland Div., Portland, Conn.##
Erdco Engineering Corp., Official Rd. & Westgate Dr., Addison, Ill.##
Hydro-Chemie, Ltd., Switzerland, (Sold by Conapac Corp., 120 East 13 Street, New York 3, N. Y.)
Packaging Industries Ltd., Inc., 151 Pine Street, Montclair, N. J.
Plastic Packaging Machine Co., Inc., 1400 Bronson Way, Renton, Washington##
Plast-O-Craft, 503 McCarter Highway, Newark 1, New Jersey##
Precision Products Co., Inc., 252 East 16 Street, Paterson, New Jersey
Product Packaging Engineering, 5713 Joanne Place, Culver City, Calif.##
Skin-Pak Machinery Co., Inc., 143 E. Railway Ave., Paterson 3, New Jersey
Taber Instrument Co., 107 Goundry St., North Tonawanda, N. Y.##
Thermomat Co., Inc., 300 Maple Ave., Trenton 8, New Jersey
Zack Radiant Heat Co., 38-40 Ann St., Passaic, New Jersey

G-P: General-purpose
S-P: Skin-packaging
V-F: Vacuum-forming
P-F: Pressure-forming
D-F: Drape-forming
PAF: Plug-assist forming

Data from this company was not received in time for inclusion in the tabulation.

Manufacturer*	Brown			Comet						Hydro-Chemie
Model number	222 Single	223 Rotary	220 Continuous	Meteor 3036	Lab-Master 1420	Star	Rotary-Vac	Elisto Matic	Quick-Pak 22	Formvac U-5
Forming method	Forms by all techniques.		G-P,D-F,PAF	D-F,S-P	Forms by all techniques. →				SP,DF,VF	G-P, All
Type of controls	Manual, auto.	Auto.	Auto.	Auto.	Auto.	Auto.	Auto.	Auto.	Auto.	Auto.
Type of feed	Cut sheets	Cut sheets	Roll or direct	Film or sheet	- - -	- - -	- - -	- - -	- - -	Cut sheets
Forming area (Lxk), min.-max., inches	10x10 - 30x36	12x12- 42x72	10x10 - 36x30	1 x 1 - 30x36	1 x 1 - 14x20	30 x 36	12x12 to 42x84	4x4 to 24x30	6x6 to 22x30	40 x 60 max.
Maximum depth of draw, inches	15	15	6	15	10	30	25	6	6	24
Rate of advance (min.-max.), in./sec.	- - -	Station to Station 4¼	3.2-24 ft./min.	0-15 adj.	0-15 adj.	5-15 adj.	0-50	- - -	0-10	- - -
Vacuum system: Pump motor hp.	1½	Two 1½	1½	1/2	1/2	3	5	2	2	132 cu. ft. max.
Working press. (min.-max.), psia. in.	25-28 Hg	25-28 Hg	25-28 Hg	3-28 Hg	3-28 Hg	3-28 Hg	3-28 Hg	3-28 Hg	3-28 Hg	- - -
Time to pump down to 3 psia., secs.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Heating: Type	2-sides	2-sides	2-sides	1-side	2-side, enclosed →		2 ovens	Contact	1-side	2-sides
Number of independent zones	3 in each heater bank		14 ea. bk.	1	2	2	2	1	1	4
Heater area (Lxk), inches	34 x 40	46 x 76	35 x 40	40 x 35	16½x24½	65 x 41	48 x 54	28 x 34	28 x 36	45 x 65
Space between sheet & heater, etc.	8-14 ea.bk.	8-12 ea.	- - -	2-22 adj.	2 - 8	10 & 24	14 - 24	2 - 8	2 - 10	- - -
Cooling, Type of	1 fan	2 fans	- - -	Fan	None	Fans	Fans	None	None	(See below)
Ejection, Type of	Air	Pneu. & mech.	Pneu.	Air&mech.	Air&mech.	Air&mech.	Air&mech.	Air&mech.	Air	Air blast
Special features	Vacuum-bleed system for plug-assist work. →			Bubble forming.	Double-platen unit, operates from either top or bottom platen.	Double-platen unit. Constant speed & pressure. Adj. platen stroke.	Vac-forms 3x capacity of extruder.	Auto.load & unload from web stock & slits in both directions.	Electric, constant speed advance. Conveyor loading. Unloads & slits into individ. packages.	(See below)
	Two-station unit.		Dupl. of all platen connections for easy tooling changes. Mold temp. control.							
Optional features	Photo-electric circuit for bubble-height control in pre-blowing. Closed-system mold temp. control unit.		Sheet-support bands. Direct trim press.	Auto. feed & slitter, plug-assist attachments. →						
				Also made in 20- & 36x30, 36x60, 48x84.	Also made in single-platen.	Also made in 36x60", 48x72", & 42x80"sizs.	All made in 36 x 60" & 48 x72" sizs.	Single platen.	Automatic product loader.	Formvac Mould Temp. Regulator.
Approx. floor space (Lxk), feet	5 x 8	14 x 16	7½ x 9	7½ x 4	3-3/4 x 2-2/3	9-1/6x7	16 diam.	3 x 10	7-1/6 x 11-1/6	12 x 7
Approx. delivery time, weeks	8 - 12	8 - 12	8 - 12	3 - 4	4 - 6	10 - 12	12	12 - 14	12 - 14	12

Manufacturer*	Hydro-Chemie (Contd.)			Packaging	Precision	Skin-Pack	Thermomat	Zack
Model number	Formvac U-7	Formvac R-4	Formvac Junior	Sentinel RF-24-K	2,2A,3,3A 4,4A,4B	F	H-1818	AV
Forming method	G-P, All	G-P, All	G-P, All	V-F	G-P, S-P	SP,VF,SP	V-F,D-F	G-P
Type of controls	Auto.	Auto.	Semi-auto.	Auto.	Manual	Semi-auto.	Manual	Auto.
Type of feed	Cut sheets	Roll or cut sheets	Cut sheets	Roll	Cut sheets	Roll	Cut sheets	Cut sheets
Forming area (Lxk), min.-max., inches	60x88 max.	10x12 max.	10x12 max.	20 x 6	10 x 20	22x34 max.	18 x 18	22x26 adj.
Maximum depth of draw, inches	32	7	7	1-3/4	3	6	7	6
Rate of advance (min.-max.), in./sec.	- - -	- - -	- - -	2	- - -	- - -	- - -	- - -
Vacuum system: Pump motor hp.	132 cu.ft. min.	10 cu.ft. min.	4½ cu.ft. min.	3/4	Manual	3/4	1/3	3/4
Working pressure (min.-max.), psia. in.	- - -	- - -	- - -	27" Hg max.	- - -	29-30" Hg	- - -	- - -
Time to pump down to 3 psia., secs.	- - -	- - -	- - -	- - -	- - -	Vacuum cycle 5-6, max.	35	- - -
Heating: Type	2-sides	2-stations	1-side	1-side	Infra-red.	Top side	Sheathed rod	1-side radiant.
Number of independent zones	6	2	1	1	1 - 2	5	1	1
Heater area (Lxk), inches	65 x 95	11 x 13	11 x 13	25 x 18	11½x11½, 11½x23	28 x 40	22 x 22	26 x 30
Space between sheet & heater, etc.	- - -	- - -	- - -	7	1/4-1/2	1½ - 6	3 - 7	2
Cooling, Type of	Provision for water-cooling & heating of molds.			Water	None	Var. fans	Blower	Fan
Ejection, Type of	Air blast	Air blast	Air blast	Slitters & cut-off	None	Air jet	Air	Air
Special features	Steplessly-adjustable clamp frames. →		Hi-speed. Extreme depth: diam.ratio. Auto. feed & trim removal.	Can be synchronized for complete automation.	Portable bench models. Ready for use.	Proport. temp. controller. Pallet loading. Auto.heating, vacuum & clamping. Auto. film cut-off.	Foot-operated drape mech-anism.	Push-button, timed control. Adjust. mold area. Fiberglass Radiant Heater.
Optional features	Air support. Auto. cycle delay.	- - -	- - -	Sentinel Blister Heat Sealing Machine.	Motorized vacuum.	In-feed conveyor. 6- or 10-inch max. draw.	Roll feed. Heat cycle timer.	Fan for cooling cycle.
Approx. floor space (Lxk), feet	- - -	14 x 8	3½ x 4	10-1/3 x 4-2/3	16 x 16 - 16 x 28	10 x 6	4½ x 2½	7 x 3
Approx. delivery time, weeks	24	32	12	12	2-3	4-5	3	4 - 5

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Machines are built to fit the individual needs of customers.

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What a Plastics Engineer Should Look For When Planning to Buy Auxiliary Equipment for Compression and/or Transfer Molding

THROUGHOUT the past 50 years—i.e., since the inception of thermosetting materials—auxiliary equipment has been designed to facilitate the storage, handling, processing, and finishing operations in compression and transfer molding. This includes all the equipment used for these processes other than presses, pumps, boilers, and molds. The rapidly-increasing production rates effected during this period have been responsible for the development of a great variety of such auxiliary equipment. The basic design considerations were to increase productivity and, at the same time, maintain close tolerances on dimensions and physical properties of the molded parts. Since cure time is of great importance in the above considerations, the major developments have been made in the areas of fast-curing resins and preheating equipment.

In planning the necessary equipment to increase production and quality economically, the plastics engineer first must be aware of the desired end results. The market offers a wide magnitude of equipment for each phase of the process, and what may be effective and economical in one application may not be in another. We will review here, step-by-step, the complete molding process from the incoming molding compound to the final count and inspection of the outgoing finished parts.

Primary Considerations

Storage

Of the three factors which must be considered in the storage area, the first and most important, is relative humidity. It is recommended that relative humidities should not exceed 65%, since excessive moisture absorbed under adverse conditions may affect not only the plastic flow properties of the material, but also its physicals.

Experience has proved that phenolic materials can be stored at normal room temperatures between 65-85° F. Since lower temperatures may affect the preform properties and cure-speed characteristics, the material should be brought to room temperature before using. Temperatures higher than 85° F. should be avoided, as some slight chemical reaction of the resin may occur which will affect the plastic flow properties of the material.

When the storage area is above ground, a floor load-capacity of 350 pounds per square foot is recommended. This is necessary in order that materials can be stored two pallets high when packed in 50-pound

bags on 2,000-pound pallets, or two drums high when packed in 300-pound fiber drums.

Materials Handling

One of the most important auxiliary pieces of equipment in plastics molding is the power-lift truck. This truck is used in three major areas; the first being to move the pallets or bag material from the storage area to the press or preform room, and to move drums to the same areas. The capacity of the power-lift truck should not be less than 2,500 pounds. This same power-lift truck also may be used for the movement of molds (which will be discussed in a later paragraph).

After material has been moved to either the molding or preform areas, it is essential to transfer the material from bags or drums to the hoppers of the molding machine. If the storage area is on the floor above these machines, material can be charged into the hoppers through holes in the storage floor. However, in cases where the storage area or the molding and preform area is on the same level, the material can be brought to hopper level by elevator or electric hoist. A second, and more economical, method is to bring the material to hopper level with a screw-type conveyor. The feeding mechanism in such conveyors is controlled automatically by limit switches in the hopper, and material can be charged into an auxiliary hopper at floor level.

When preforms are used, it is essential to maintain uniformity of the charge, and it may be desirable to tumble the drums before charging the material into the hopper. Uniformity of weight, density, and hardness in the preforms is extremely important in the molding process.

Preform Presses

Preforming is the process of cold-compressing the molding powder into tablets, either cylindrical or of special shapes, to facilitate the molding operation. Preforming shortens the molding cycle by removing air from the material during the compressing process. The preform weight, once established, will remain relatively constant throughout the run with only occasional check-weighing being necessary. The use of preforms is established practice in electronically-preheating the molding charge. Because preforms are practically free of dust, the chances of contamination of one material by another during the molding process are reduced considerably.

It is advisable that a gram scale of at least 500-gram capacity be installed permanently adjacent to the preform machine in order that the weights of preforms can be established and controlled accurately in accordance with molding requirements.

Preforming presses are available in many types and capacities. Single-stroke presses having a range from 8-60 strokes per minute are available with three different mechanisms: (1). An eccentric cam having a capacity of 10-60 tons; (2). A reciprocating press having capacities of 30-200 tons; and (3). A hydraulic press having a capacity of 25-200 tons. Rotary presses which compress the material from both bottom and top can operate on 15-33 sets of dies at once, and produce 175-1,700 preforms per minute. The rate of production is determined mainly by the geometry and weight of the preform. Rotary presses have a compression range from 2½-35 tons. Special preforming presses are available for handling bulky, high-impact materials.

General-purpose phenolic, urea, and melamine molding materials have bulk factors ranging from 2.2-2.8 to 1. Where it is necessary to preform higher-impact materials containing fibrous fillers, special agitating devices or fixtures may be required on the preform feed hopper. These can be supplied by the machine manufacturer.

Preform Area

It is recommended that the preforming area be completely enclosed and separate from other plant areas because considerable dust is generated in the preforming process. A suitable exhaust fan should be installed for discharging to a dust collector which is properly grounded. It also is suggested that the preform machines be equipped with a vacuum hose, the nozzle of which should be adjacent to the preforming die in order to pull off the fines and dust generated during the reciprocating action of the force plugs. This same vacuum system can be used for cleaning the preform machine and the preforming area when changing the preform dyes or the material being processed.

Predrying of Material

The normal moisture content of many thermosetting molding materials will range from 1-3%. This moisture content is important in maintaining electronic preheating and flow properties. In certain applications, however, it may be necessary when molding with powder, to predry the material at temperatures between 150-200° F. It also may be desirable to predry the preforms immediately prior to molding. This process not only removes moisture, but considerably improves the electrical properties and dimensional stability of finished parts. The length of time and the temperature range for predrying preforms varies widely depending on preform size, density, and design; the type of equipment; and many other factors.

Preheating

Preheating and predrying both involve heat, but are different in application. Predrying is the heating of the molding material to drive off moisture and/or volatiles. Preheating is the application of heat to the molding material to deliver the material to the molding cavities at a temperature close to the required molding temperature. In some cases, drying and preheating are achieved in one operation. Preheating the material allows for shorter molding cycles because the material is hot when the mold is charged, thereby decreasing cure time. It also promotes dimensional stability, reduces required molding pressure, and makes possible larger molded parts with deeper draw.

In preheating, as in preforming, there is a wide variety of equipment available. There are three major methods of preheating, as follows:

CIRCULATING HOT AIR OVEN. In this type of preheating, heat may be generated in these ovens by the use of electric heating units or steam coils. Gas ovens are recommended only if the flame is completely separated from the heating area.

Oven preheating is a slow process since thermosetting materials are very poor conductors of heat, and the powder or preforms must be heated from the outside in. It is difficult, therefore, to get a uniform preheat temperature throughout the whole mass without encountering precure of the surface material. Oven-type preheating normally is not used in automatic molding, and is confined mainly to semi-automatic molding where specific charges of the material may be brought from the oven to the press as required.

INFRARED PREHEATING. This type of preheating can be used to greatest advantage in automatic powder molding. Here, infra-red lamps are mounted directly over the material in the hopper at the press. A constantly-moving hopper agitator prevents portions of the material from remaining static and becoming overheated. The material is fed into the preheating hopper from a secondary bin or conveyor belt. The material also may be preheated with infra-red lamps by passing the material under the lamps on a belt conveyor from which it is discharged into the hopper of the molding press.

DIELECTRIC PREHEATING. The most effective equipment for preheating thermosetting materials, especially preforms, is the dielectric type. Developed by Union Carbide, it produces heat within the material by inducing molecular friction due to extremely rapid oscillation of the current between the electrodes. In the early days of dielectric preheating, equipment operated in the 15-27 megacycles range. Present-day preheaters operate in the 65-90 megacycles range and give more rapid and uniform preheating. The main advantage in dielectric preheating is that material is preheated from the center of the mass outward in a matter of seconds. Dielectric preheaters are available in capacities from 2-22 kilowatts.

There is available today a wide variety of high-frequency dielectric preheaters, depending on the type of molding process used. Loading-board preheaters are designed for use with multiple-cavity molds for compression molding. These preheaters also may be used for heating multiple preforms in transfer or plunger molding. Dielectric preheating is used extensively in both automatic compression molding and automatic plunger or transfer molding. There are several methods of conveying the material to the preheater, and then directly into the mold or plunger well.

When preheating preforms, they may be conveyed on a belt or sliding tray between the electrodes of the preheater. The movement of the belt or tray is synchronized with the molding cycle of the press and the preheating time. When preheating powder automatically, the powder from a feed hopper is charged volumetrically into special plastic cups. Next, these cups are moved to a position between the electrodes where the material is preheated. The cups then are conveyed rapidly, usually by a chain or rack-and-pinion mechanism, to a position immediately over the mold where the material is discharged into the mold cavities. It sometimes is necessary to use plug assistance to force the material from the special plastic cups into the cavities, since the material has a tendency to sinter during the preheating process.

Preform Hardness

Preform hardness of thermosetting molding materials has a major effect on their radio-frequency preheat characteristics. Measurement of the preform hardness with a Durometer "D"-scale tester is a simple and accurate method for controlling preform hardness once the optimum hardness rating has been established for a given material and preform size. Preforms having a uniform hardness or density will preheat electronically to a more uniform temperature, cycle after cycle. This reduces to a minimum the molded parts which are blistered due to undercure from too-cool preforms, or porous molded parts due to precure of the material from preforms which are too hot. The actual hardness of the preform as measured by the Durometer tester is not as important as the hardness range in which the production lot of preforms is maintained. This is particularly important where multiple stacks of preforms are preheated simultaneously.

The fundamental operation of this type of hardness tester consists of penetrating the preform with a needle-like indentor. The geometry of the puncturing point of the indentor and the spring pressure behind it are determined by the type of material being tested. For thermosetting molding materials, the type "D" Shore tester is recommended. This tester has a spring pressure of 10 pounds with an indentor having a sharp 30° included angle point. The length of the indentor is 0.10". The quadrant style dial is rated from 0 to 100, and indicates inversely the distance of penetration of the indentor into the preform. For example, the dial reading is zero when the preform is extremely soft, and 100 when the preform is extremely hard. The following preform hardness rating are recommended:

	Preform Hardness Range
General-Purpose Phenolic Molding Material	50-70
Mineral-Filled, Heat-Resistant Phenolics	60-70
Improved-Impact, Cotton Flock-Filled Materials	50-60

Mold Storage

When molds are not in use, storage in a low-humidity area is advisable. Temperature of the storage area is not of major importance, but high-humidity areas can cause irreparable damage due to mold rust and corrosion. Even under ideal storage conditions, mold cavities and force plugs should be coated thoroughly with a non-oxidizing grease for maximum protection.

On removal of the molds from storage and after mounting in the press, this grease should be cleaned off thoroughly with a non-flammable, non-toxic solvent. The fork-type lift truck is almost a necessity to accomplish safe and rapid movement of the molds to and from the storage area, and for mounting them in the press.

Mold

When a new mold is put into production, or an old mold from storage is started up, it is important that the surface of the cavities and force plugs be free of contaminating grease and oil. After the mold has been brought up to molding temperature in the range of 300-375° F., the surfaces of the cavities and force plugs should be coated lightly with melted carnauba wax or a special silicone release agent. After five or six cycles are run with the mold thus lubricated, the natural lubricating agent of the molding material will have formed a film on the mold, and should require no further lubrication during production. In the event that sticking of flash to the cavities is encountered during the start-up period, a brass rod which has been ground to a sharp point and a brass-headed hammer or a 100-psi. air hose with a brass nozzle should be available for removing the flash from the mold. Steel or other hard metals should never be used as accessory tools, since they will cause costly damage to the highly-polished surfaces of the cavities and force plugs.

Pyrometers

One very necessary piece of auxiliary molding equipment is a pyrometer for accurately checking not only the mold temperature as such, but also variations in mold temperature from cavity-to-cavity and force plug-to-force plug. This is important, because variations in molded temperature will result in high rejection rates for molded parts due to non-curing and blistering in the cavities which are too cold, or to precuring and porous parts from cavities which are too hot. If molds are not uniform in their temperature gradient, corrections should be made immediately by adding electrical heating units in the platen, or encasing the sides of the mold with asbestos sheet.

The pyrometer should not only be used for checking mold temperatures with the thermocouple, but also should have a thermocouple needle attachment which should be used in periodically checking the temperature of the dielectrically-preheated preforms. It is essential that individual preforms, when preheated in multiple stacks, be of uniform temperature.

Normally, preforms preheated in the temperature range between 225 and 250° F. give the best flow properties and fastest cure conditions for the average material. Once the proper preform temperature is established for a given material and molding conditions, the needle pyrometer should be used periodically to check this temperature. The recommended temperature then is set up on the molding instruction card.

Finishing of Molded Parts

Finishing of molded parts may be divided into two distinct classes: deflashing and buffing.

Deflashing

Practically all molded parts as they come from the mold have a degree of flash caused by a small amount of material flowing out through the parting line of the mold, or in through the holes where pins from the opposite sides of the mold abut. On uncomplicated parts such as bottle caps, this flash may be removed with tumbling equipment. This is in the form of a cylindrical barrel on a horizontal axis which revolves at a rate of 15-25 rpm.

Included with the charge of molded parts are wooden pegs or small wooden blocks, which will assist in removing the flash, and give a light polish to the parts. The barrels may be of octagonal cross-section, with alternate open and closed panels. The open panels are covered with screens of wire mesh, which will let the small flash fragments fall out. If the parts have grooves or projections, it often is advisable to tumble them in the barrel in combination with string mops impregnated with polishing wax. These mops are impregnated easily by tumbling them with wax in a clean barrel.

A significant innovation in the deflashing process is the Wheelabrator. It utilizes a stream of small pellets, usually crushed fruit pits, projected at high speed at the molded parts which are tumbling over a continuous belt mechanism within the unit. The pellets, although hard, are not as hard as the molded parts. Hence, they are non-abrasive to the material, yet remove the flash not only from the periphery of the molded parts, but also from holes and other complexities. In the case of large parts, these are carried through the stream of pellets on a rotating table which is enclosed within the unit.

On certain large moldings, where their complex design makes tumble deflashing or wheelabrating impractical, it is necessary to hand-deflash using a file or broaching tools.

Buffing

It is sometimes necessary after flash removal to produce a high-lustre finish on the molded parts for such applications as piano keys and certain knobs and handles. Parts requiring a high gloss may be buffed on high-speed cloth buffing wheels, using a fine rouge polishing compound. This process may be advisable on plunger or transfer molded parts at the point where the gate has been removed from the part.

Conclusions

The preceding outlines and describes the major types and variations of auxiliary equipment for compression and transfer molding. Some molded parts, depending upon their complexity, may require additional operations such as drilling, tapping, reaming, or sizing. However, each of these operations should be considered as a specific operation that is semi-independent of actual compression or transfer molding auxiliary equipment.

—The End

PT's Comparative Data on 1960

Compression and/or Transfer Molding Machines.

(Based on data submitted by the machine manufacturers)

Manufacturer*	Atlas					Baker			
Model number	Series 100	Series 125	Series 200	Series 250	Series 300	60 & 75 Ton	100 & 150 Ton	175-Ton	200-Ton
Machine action	Hand	Manual	Manual or Semi-automatic →			Auto.	Auto.	Auto.	Auto.
Machine design type	Slab-side	Slab-side	H-d slab-side →		4-column	Top ram open strain rod-type fully self-contained: →			
Press capacity, tons: Compression	20,30,40	30,50	50,75	50-300	25-200	60,75	100,150	175	200
Transfer	None	None	To specification. →			Auto. 15-Ton	Auto. 30-Ton	Auto. 30-Ton	Auto. 50-Ton
Casting area#, square inches	- -	- -	- -	- -	- -	- -	- -	- -	- -
Ram or plunger: Stroke, inches	4	6	6	To specification. →		13	15	15	18
Diameter, inches	4,5,6	5,6	6,8	6-16	5-14	7¼,8½	8-3/4,11	12¼	13
Pressure on material**, psi.	- -	- -	- -	- -	- -	- -	- -	- -	- -
Cycles per hour**	- -	- -	- -	- -	- -	- -	- -	- -	- -
Speeds, inches/minute: Closing	- -	70	70	60-400	60-400	400	- -	400	400
Opening	- -	60	60	To specification. →		400	400	400	400
Platens or molds: Size (max.), inches	6x8-12x12	10x10,12x12	12x12,14x14	14x14-24x24 →		16x20	20x24	20x24	28x34
Number of platens	2 or 3	2 or 3	2 or 3	To specification. →		- -	- -	- -	- -
Daylight opening, in. (max.)	8	6	6	To specification. →		29	33	33	38
Thickness (min.-max.)##in.	- -	- -	- -	- -	- -	10	12	12	14
Locking force, tons	20,30,40	30,50	50,75	50-300	25-200	- -	- -	- -	- -
Tie bars or rods: Diameter, inches	- -	- -	- -	- -	- -	2½	4	4	5
Space between, inches	- -	- -	- -	- -	- -	- -	- -	- -	- -
Material heating capacity, kw.	- -	- -	- -	- -	- -	6	12	12	20
Type of heating	Steam or electric. →					Electric	Electric	Electric	Electric
Motor hp.	Hand pump	Auto. pneumatic. →		Depends on closing speed required. →		7½	10	15	15
Approx. floor space (LxW), feet	1 x 1½	1½ x 1½	1½ x 3	3x3-5x7	2x3-4x6	- -	- -	- -	- -
Special features	Bench model with self-contained 2-stage hydr. pump. →	Ready for immediate operation.	Precision press for accurate research & testing work. Adj. hydr. press.	Precision press for accurate, deflection-free molding & laminating. Built-in pressure & spd. control.	Rugged press for low-cost compr. or transfer molding. Many adj. features for max. versatility.	Flexible feeding & measuring loaderboard for all mold combinations. Upper and lower independent hydr. ejection. Meets I.C. standards. Deceleration at any time in pressing stroke. Breathe for any length of time. Throw-away type relays. All platens T-slotted. All cycles instantly adjustable. Ejectors supplied front to back and two options right to left. →			
Optional features	Can be built to customer's specifications & controls. →					Hydraulic side cores available. →			
Approx. delivery time, weeks	4 - 6	5 - 8	6 - 10	6 - 12	6 - 12	- -	- -	- -	- -

* Complete company names and addresses are as follows:

Adamson United Co., 730 Carroll St., Akron 4, Ohio ###
Atlas Hydraulics Div., Delaware Valley Mfg. Co., Inc., 3576 Ruth St., Phila. 34, Pa.
Automold Co., 2231 S. Butler Ave., W. Los Angeles 64, Calif.***
Baker Brothers, Inc., 1000 Post St., Toledo, Ohio
Baldwin-Lima-Hamilton Corp., Hamilton Div., Hamilton, Ohio
Stewart Bolling & Co., Inc., 3190 E. 65th St., Cleveland 27, Ohio
Fred S. Carver, Inc., 1 Chatham Rd., Summit, N. J.
Clifton Hydraulic Press Co., 287-293 Allwood Rd., Clifton, N. J.***
Custom Machine & Design, Inc., P. O. Box 1064, Akron 9, Ohio ###
Dake Corporation, Grand Haven, Mich. ###
Davidson-Kennedy Co., 1090 Jefferson St. N.W., Atlanta 18, Ga.
Dunning & Boschert Press Co., Inc., 329 W. Water St., Syracuse 2, N. Y.
Erie Engine & Mfg. Co., 953 E. 12th St., Erie, Pa.
Erie Foundry Co., Erie 6, Pa.
Farrel-Birmingham Co., Inc., Watson-Stillman Press Div., 565 Blossom Rd., Rochester 10, N. Y.
French Oil Mill Machinery Co., Piqua, Ohio ###
Hull-Standard Corporation, Hatboro, Pa.
Hydraulic Press Mfg. Co., Marion Rd., Mount Gilead, Ohio
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Knuth Engineering Co., 1720 N. California Ave., Chicago 47, Ill.
Lake Erie Machinery Corp., P. O. Box 68, Buffalo 17, N. Y.
Logan Hydraulics, Inc., 4901 W. Lawrence Ave., Chicago 30, Ill.
M & N Hydraulic Press Co. Inc., P. O. Box 504, Clifton, N. J.***
Pasadena Hydraulics, Inc., 1433 Lidcombe, El Monte, Calif.
Rodgers Hydraulics, Inc., 7401 Walker St., Minneapolis 16, Minn.
F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa.
Wabash Metal Products Co., 1569 Morris St., Wabash, Indiana

** In compression molding, is a function of mold size and shape; in transfer molding, is related to diameter of the transfer plunger.

*** Data from this company was not received in time for inclusion in the tabulation.

Depends on part configuration and specific molding compound.

Depends on daylight openings.

Only in Custom-Made to Order listing.

Manufacturer*	Baker (Cont'd)		Baldwin-Lima-Hamilton						Carver	
Model number	300-Ton	450-Ton	100C	200C	300C	100T	200T	300T	Standard	20-Ton
Machine action	Auto.	Auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Manual	Manual
Machine design type	(See preceding page)		4-column	4-column	4-column	4-column	4-column	4-column	Rod-type	Rod-type
Press capacity, tons: Compression	300	450	100	200	300	100	200	300	12	20
Transfer	Auto. 75-Ton	Auto. 125-Ton	- - -	- - -	- - -	28	50	78	- - -	- - -
Casting area#, square inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Ram or plunger: Stroke, inches	18	24	12	15	18	12	15	18	6½	6½
Diameter, inches	16	24	11	15	19	11	15	19	2.03	1.77
Pressure on material**, psi.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Cycles per hour **	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	Variable	Variable
Speeds, inches/minute: Closing	400	400	320	300	260	320	300	260	Variable	Variable
Opening	400	400	160	185	160	160	185	160	Variable	Variable
Platens or molds: Size (max.), inches	28x34	36x42	24x20	30x24	36x30	24x20	30x24	36x30	6x6	8x8
Number of platens	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	2	2
Daylight opening, in. (max).	38	42	- - -	- - -	- - -	- - -	- - -	- - -	16½	16½
Thickness (min.-max)## in.	14	14	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Locking force, tons	- - -	- - -	100	200	300	100	200	300	- - -	- - -
Tie bars or rods: Diameter, inches	5	6½	- - -	- - -	- - -	- - -	- - -	- - -	1-1/8	1-3/8
Space between, inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	7-3/8	9-1/4
Material heating capacity, kw.	20	30	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Type of heating	Electric	Electric	Steam or electric. →						- - -	- - -
Motor hp.	20 (two)	20 (two)	10	20	25	10	20	25	- - -	- - -
Approx. floor space (LxW), feet	- - -	- - -	5½ x 2½	7½ x 3	8 x 3	5½ x 2½	7½ x 3	8 x 3	18x16x36 inches	19x19x42 inches
Special features	(See preceding page)		Top and bottom ejectors. →						Bench model. Self-contained. →	
Optional features	(See preceding page)		Hot plates. Daylight opens to customer's specifications. →						Steam or electric hot plates. Electric heating. →	
Approx. delivery time, weeks	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	Stock	Stock

Manufacturer	Davidson-Kennedy					Erie Engine			
Model number	101,102	103,104	105,106	107	108	50	100	200	300
Machine action	Manual and automatic →					Manual or semi-automatic →			
Machine design type	- - -	- - -	- - -	- - -	- - -	Rod-type	Rod-type	Rod-type	Rod-type
Press capacity, tons: Compression	50	100	100,200	200,400	200	50	100	200	300
Transfer	- - -	- - -	- - -	- - -	- - -	15	20	40	75
Casting area#, square inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Ram or plunger: Stroke, inches	36	50	50	58	58	Variable	Variable	Variable	Variable
Diameter, inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Pressure on material**, psi.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Cycles per hour **	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Speeds, inches/minute: Closing	700	600	500	400	350	Variable	Variable	Variable	Variable
Opening	300	300	300	300	300	Variable	Variable	Variable	Variable
Platens or molds: Size (max.), inches	- - -	- - -	- - -	- - -	- - -	18 x 16	24 x 18	30 x 24	36 x 30
Number of platens	2	2	2	2	2	Optional	Optional	Optional	Optional
Daylight opening, inches	36	50	50	58	58	Optional	Optional	Optional	Optional
Thickness (min.-max.)##, in.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Locking force, tons	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Tie bars or rods: Diameter, inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Space between, inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Material heating capacity, kw.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Type of heating	Steam or electric. →					Optional	Optional	Optional	Optional
Motor hp.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Approx. floor space (L x W), feet	2x3, 3x4	3x4, 3½x5	4-1/6 x 6-2/3	5x8-1/3	5 x 10	4 x 2½	5½ x 3½	6 x 3½	6½ x 5
Special features	Automatic bumping & ejection. Pyrometer temperature control. Max. pressing speed, 15 inches/minute. Operates on 100 psi. air pressure. Max. hydraulic line pressure, 6,000 psi. →					- - -	- - -	- - -	- - -
Optional features	To suit customers' requirements. →					Design styles can be modified to meet customers' requirements. Can be equipped with pull-back or push-back cylinders. →			
Approx. delivery time, weeks	- - -	- - -	- - -	- - -	- - -	14 - 16	14 - 16	14 - 16	14 - 16

Manufacturer*	Erie Engine (Cont'd)		Erie Foundry				Farrel-Birmingham			
Model number	500	750	Series 1100	Series 1120	Series 1130	Series 1150	9382-C 9382-T	9379-C 9379-T	9383-C 9383-T	9384-C 9384-T
Machine action	Manual or semi-auto.		Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.
Machine design type	Rod-type	Rod-type	4-rod	4-rod	4-rod	4-rod	Four-column, open type.			
Press capacity, tons: Compression	500	750	100	200	300	500	50	100	200	300
Transfer	125	200	25	55	75	125	12½ (T)	25 (T)	50 (T)	75 (T)
Casting area#, square inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Ram or plunger: Stroke, inches	Variable	Variable	12 (C) 15 (T)	15 (C) 15 (T)	18 (C) 18 (T)	36 (C) 18 (T)	12 (C) 9 (T)	30 (C) 12 (T)	15 (C) 12 (T)	18 (C) 14 (T)
Diameter, inches	- - -	- - -	11	13	17½	21	7 x 7½	11x10½	15x14½	18x6½
Pressure on material**, psi.	- - -	- - -	- - -	- - -	- - -	- - -	2,300#	2,200#	2,300#	2,350#
Cycles per hour**	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Speeds, inches/minute: Closing	Variable	Variable	235	270	435	400	220 335 (T)	260 320 (T)	230 208 (T)	230 144 (T)
Opening	Variable	Variable	235	240	435	400	220 127 (T)	220 158 (T)	230 138 (T)	230 100 (T)
Platens or molds: Size (max.), inches	42 x 36	66 x 42	20 x 21	30 x 24	36 x 36	40 x 32	16x16##	20x21##	30x24##	33½x27##
Number of platens	Optional	Optional	2	2	2	2	2	2	2	2
Daylight opening, inches	Optional	Optional	42	50	62	84	25###	50###	32###	38###
Thickness (min.-max.)##, in.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Locking force, tons	- - -	- - -	100	200	300	500	50	100	200	300
Tie bars or rods: Diameter, inches	- - -	- - -	3½	4-3/4	5½	7	2½	3	4½	5½
Space between, inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Material heating capacity, kw.	- - -	- - -	- - -	- - -	- - -	- - -	None	None	None	None
Type of heating	Optional	Optional	- - -	- - -	- - -	- - -	None	None	None	None
Motor hp.	- - -	- - -	10	15	20	30	3	5	10	10
Approx. floor space (Lxb), feet	10½ x 6	13 x 6½	5 x 3½	6 x 5	7 x 6	7½ x 6½	3-5/6 x 4-1/3	4-1/3 x 4-1/2	4-11/12 x 5-1/3	6-1/12 x 5-2/3
Special features	- - -	- - -	All presses provided with hydr. mold stripping cyls., separate advance cyls., slow break away speed, high pull-back tonnages.				(C) Top and bottom k-o; fast die closing & opening with auto. slow-down prior to contact; individ.-type timers; inching valve for die-setting. Presses 500-tons or larger have hi-& low-press. pressing speeds, hydr. stripping cylinders. (T) Double-acting ram; selective control for either compr. or transfer molding; high degree of cycle control; hydr. stripping cyls. Models 9654 and 10026 are inverted transfer presses.			
Optional features	(See preceding page)		Additional degassing, adj. opening, bolsters & parallels. Stroke & daylight opening to order.				(C) Degassing feature; adj. opening spacers; bolsters and parallel plates; adj. opening in two 4-inch steps. (T) Top bolster for compression molding; degassing feature.			
Approx. delivery time, weeks	14 - 16	14 - 16	16	20	20	20	- - -	- - -	- - -	- - -

Operating pressure for machine.
Die space.
Opening between platens.

Manufacturer*	Farr.-Birm. (Cont'd)		Hull Standard						H-P-M	
Model number	9654-T	10026-T	99A	350/359-D	250/259-E&C	350/359-E&C	450-E&C	550-E&C	100 Ton	200 Ton
Machine action	Semi-auto.	Semi-auto.	Auto.	Semi-auto.	Semi-auto.	Semi-auto.	Auto.	Auto.	Manual or semi-auto.	
Machine design type	Side-plate	Side-plate	Horiz. pneumatic.	Straight-ram console	Vertical, toggle-type.	Vertical, straight-ram	Vertical, toggle-type.	Vertical, straight-ram.	Rod	Rod
Press capacity, tons: Compression	100	200	15	28	50-300	50-300	50-300	50-300	100	200
Transfer	25	45	2	7	19-43	12½-75	Special	Special	35#	50#
Casting area#, square inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	24 x 18	30 x 24
Ram or plunger: Stroke, inches	14 (C) 5 (T)	18 (C) 6 (T)	1-7/8 (C) 12 (T)	6 (C) 8½ (T)	7-10 (C) 9-12 (T)	12-18(C) 10-14(T)	7 - 10	12 - 18	15	15
Diameter, inches	16x15(C) 11x10(T)	16x15-⅞ (C) 8x7½ (T)	- - -	- - -	- - -	- - -	- - -	- - -	11	16
Pressure on material**, psi.	- - -	- - -	Depends on mold design.						- - -	- - -
Cycles per hour**	- - -	- - -	*	*	*	*	*	*	- - -	- - -
Speeds, inches/minute: Closing	260 43 (T)	250 45 (T)	- - -	190	190-322	282-364	- - -	- - -	235	210
Opening	185 75 (T)	190 92 (T)	- - -	192	107-322	262-324	- - -	- - -	90	80
Platens or molds: Size, inches	22x21##	30x24##	7½ x 4½#	18x18#	18 x 18-3/4 to 36 x 31 #				24 x 18	30 x 24
Number of platens	2	2	2	2	2	2	2	2	One set	One set
Daylight opening, in. (max.)	34###	38###	4½	21	21 - 30	24 - 44	21 - 30	24 - 38	30	36
Thickness (min.-max.)##, inch.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	3 min.	9 min.
Locking force, tons	100	200	15	28	50-300	57½-312	50-300	57½-312	100	200
Tie bars or rods: Diameter, in.	- - -	- - -	2-3/4	1-3/4	2-9/16-4	2-9/16-4-3/4	2-9/16-4	2-9/16-4-3/4	3½	4½
Space between, inches	- - -	- - -	7½	18-3/4	21 - 40	21 - 39	21 - 40	21 - 39	32-3/4	39½
Material heating capacity, kw.	None	None	0.96	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	To customer's specifications.	
Type of heating	None	None	Electric	Steam, oil, or electric					Steam or electric.	

(Continued on following page)

Manufacturer*	Farr.-Birm. (Cont'd)		Hull Standard (Cont'd)						H-P-M (Cont'd)	
Model number	9654-T	10026-T	99A	350/359-D	250/259-HC	350/359-HC	450-HC	550-HC	100 Ton	200 Ton
Motor hp.	7½	15	80 psi air	5	3 - 10	3 - 20	3 - 10	3 - 20	5 (C) 7½ (T)	7½ (C) 10 (T)
Approx. floor space (LxW), feet	33-2/3 x 3-5/6	5-5/6 x 4	7 x 2	4½ x 2½	5 x 5 to 8 x 5**	5 x 5 to 8 x 6**	5 x 8 to 8 x 10**	5x8 to 8 x 10**	31 sq.ft.	36 sq.ft.
Special features	(See preceding page)		Integral heating; std. mold frames; uses cold granular feed; positive k-o & strippers.	Self-contained hydr. system; positive bottom k-o; adj. slow close; quickset controller.	Low pressure hydraulic system. Compr. units can be converted to transfer molding & for fully auto. operation. Quickset controller. Adj. slow-close control; top & bottom ejector system.		16-station Universal Hopper Feeder; All-electric drive for loading board & k-o; double-shot protection.		Both compression and transfer models available.	
Optional features	(See preceding page)		Controls arranged for semi-automatic molding with inserts; automatic h-f preheating.	Manual controls; top ejector system; hydr. ejectors.	Hydraulic ejector system.		Automatic h-f preheating.		Hot plates.	
Approx. delivery time, weeks	- - -	- - -	4 - 6	10 - 12	Depending on size		10 - 20	12 - 20	- - -	- - -

(See preceding page for footnotes.)

* Depends on part design, material & operator ability.
** Plus space for power unit.
# Die space.

#Applies only to transfer models.

Manufacturer*	H-P-M (Cont'd)		King						Knuth	
Model number	300 Ton	500 Ton	7100	7200	7300	7500	8624	7703	130	160
Machine action	Manual or semi-auto.		Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Manual	Manual
Machine design type	Rod	Rod	4-column	4-column	4-column	4-column	4-column	4-column	Side-plate.	Side-plate.
Press capacity, tons: Compression	300	500	100	200	300	500	750	1,000	1½	3
Transfer	80#	125#	25	50	75	125	200	250	- - -	- - -
Casting area#, square inches	36 x 30	42 x 36	Approx. 65 (C) 10 (T)	Approx. 135 (C) 20 (T)	Approx. 200 (C) 25 (T)	Approx. 330 (C) 33 (T)	Approx. 500 (C) 53 (T)	Approx. 650 (C) 70 (T)	36	36
Ram or plunger: Stroke, inches	18	26	12 (C) 12 (T)	15 (C) 12 (T)	18 (C) 14 (T)	24 (C) 16 (T)	30 (C) 18 (T)	36 (C) 20 (T)	7	7
Diameter, inches	19½	25	2½ (C)	3½	4	5	6	7	- - -	- - -
Pressure on material**, psi.	- - -	- - -	10,000	10,000	12,000	15,000	15,000	14,000	83	166
Cycles per hour**	- - -	- - -	120	120	120	100	90	90	- - -	- - -
Speeds, inches/minute: Closing	204	315	285	310	300	310	275	265	- - -	- - -
Opening	100	104	245	240	185	165	165	200	- - -	- - -
Platens or molds: Size (max.), inches	36 x 30	42 x 36	24 x 20	30 x 26	36 x 30	42 x 36	66 x 42	72 x 50	8 x 8	8 x 8
Number of platens	One set	One set	One set	One set	One set	One set	One set	One set	2	2
Daylight opening, in. (max.)	54	54	24	36	44	54	60	72	16	16
Thickness (min.to max.), in.	12 min.	12 min.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Locking force, tons	300	500	100	200	300	500	750	1,000	- - -	- - -
Tie bars or rods: Diameter, inches	5¢	6½	1½	4½	5½	7	8	9	- - -	- - -
Space between, inches	44-3/4	51	29 x 10½	28 x 14	41 x 15½	48 x 24	72 x 26	80 x 30	8	8
Material heating capacity, kw.	To customers' specification.		- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Type of heating	Steam or electric.		- - -	- - -	- - -	- - -	- - -	- - -	Steam or electric.	
Motor hp.	15 (C) 20 (T)	25 (C) 45 (T)	7½	15	20	25	30	30	- - -	- - -
Approx. floor space (LxW), feet	53 sq.ft.	58 sq.ft.	5½ x 3½	6 x 3½	7½ x 5	10½ x 6	13 x 7½	15 x 8	1 x 1	1 x 1
Special features	(See above)		Side plate-type and housing-type units can be supplied to customers' specifications, as can press speeds, daylight openings, and die openings. All presses are electric bushbutton-operated and have electric timer-controlled cure periods.						Table-top laboratory units.	
Optional features	(See above)		Fully automatic units can be furnished.						Hot & cold plates.	
Approx. delivery time, weeks	- - -	- - -	Depends on backlog, etc. at time of order.						3	3

Same as above.

Manufacturer*	Lake Erie				Logan	M & N		Pasadena		
Model	Compression Presses	Transfer Presses Opposed Ram	Transfer Presses Up-Stroke Type	Multiple-Press	Compr. & Transfer Presses	Compression	Transfer Presses	PW	Q230 Type	B230 Type
Machine action	Semi-auto.	Semi-Auto.	Semi-auto.	Semi-auto.	Semi-auto.	Manual & semi-auto.	Semi-auto.	Manual	Manual	Manual
Machine design type	Rod	Rod	Rod	Rod	Rod-type	Rod	Rod	Bench	Bench	Bench
Press capacity, tons: Compression	50-2,000	100-500	200;300	20-75 tons/ram	10-300	25-300	- - -	20	30	50
Transfer	- - -	35-160	50;75	- - -	10-60	- - -	25-100	118	156	156
Casting area#, square inches	- - -	- - -	- - -	- - -	100-1,080	- - -	- - -	- - -	- - -	- - -
Ram or plunger: Stroke, inches	10-36	12-24	14	9-18	6-18 (C) 8-14 (T)	8-12	- - -	4	4	6
Diameter, inches	- - -	- - -	- - -	- - -	4-20 (C) 4-9 (T)	6-16	6-10 (C) 10-12 (T)	4	5	5-3/4
Pressure on material**, psi.	- - -	- - -	- - -	- - -	100-18,000	2,500-3,000	- - -	338 lbs.	384 lbs.	641 lbs.
Cycles per hour**	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Speeds, inches/minute: Closing	- - -	- - -	- - -	- - -	5-450	23-60	- - -	- - -	- - -	- - -
Opening	- - -	- - -	- - -	- - -	5-400	80-120	- - -	- - -	- - -	- - -
Platens or molds: Size (max.), inches	15x15 to 72x48	24x18 to 42x36	30x24; 36x30	12x12 to 24x16	9x9 to 30x36	12x12 to 14x30	- - -	12½ x 9	12½x12½	12½x18½
Number of platens	- - -	- - -	- - -	- - -	2	2	2	2 - 3	2 - 3	2 - 6
Daylight opening, inches (max.)	18 - 60	18 - 30	20	20 - 30	9 - 42	8-30 min.	22	4	4	6
Thickness (min.-max.)##, in.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Locking force, tons	- - -	- - -	- - -	- - -	10-300	- - -	- - -	20	30	50
Tie bars or rods: Diameter, inches	- - -	- - -	- - -	- - -	1-3/4-6	4½-14	- - -	13#	13#	13#
Space between, in.	- - -	- - -	- - -	- - -	10-44	- - -	- - -	- - -	- - -	- - -
Material heating capacity, kw.	- - -	- - -	- - -	- - -	Variable	- - -	- - -	3	4	4
Type of heating	- - -	- - -	- - -	- - -	Steam or electric.	Steam or electric. →		Steam or	electric.	Electric
Motor hp.	- - -	- - -	- - -	- - -	3 - 75	3 - 7½	7½ - 10	- - -	- - -	- - -
Approx. floor space (LxW), feet	- - -	- - -	- - -	- - -	20-57 sq. ft.	30x48 to 48x58	12x12 to 20x20	1x1-7/12	1x1-7/12	1-1/6x 1-7/12
Special features	- - -	Self-contained with auto. timer, stripper reset & limit switches. →		Multiple self-contained units with grids & strippers for semi-auto. Individually operable.	Std. units include all hydr. & control equipment.	Adj.head & power ram return; adjustable daylight.	Push-button controls & timer. Indep. press. control of both rams.	2-stage pump that can be converted to semi-auto. operation. Can be adapted to another 4 inches in daylight. →		
Optional features	Self-contained or accum. types. Standard or special controls.	- - -	- - -	- - -	Can be converted to auto. operation. Specs. can be varied to meet customers' specs.	Gravity return platens, pressure regulator; motor shut-off for long cycles. Speeds as required.	Pressure speeds & timers to customers' specs.	Modifications to suit customers' requirements. →		
Approx. delivery time, weeks	- - -	- - -	- - -	- - -	6 - 20	- - -	- - -	- - -	- - -	- - -

Manufacturer*	Pasadena (Cont'd)			Rodgers				Stokes		
Model number	B240 Type	H8 Type	K-10-360 Model	TCMA-100-2420-10	TCMA-150-2420-20	TCMA-200-3624-10	TMCA-300-3630-10	725	800	741
Machine action	Manual	Semi-auto.	Semi-auto.	Manual, semi-auto., automatic. →				Auto.	Auto.	Auto.
Machine design type	Floor model	Floor model	Floor model	Rod-type	Rod-type	Rod-type	Rod-type	Rod	Rod	Rod
Press capacity, tons: Compression	50	70	125	100	150	200	300	25	15*	75**
Transfer	231	342	600	25	32	40	60	5	- - -	- - -
Casting area#, square inches	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Ram or plunger: Stroke, inches	6	8	10	Ram 24, plunger 11. →				5	5	12
Diameter, inches	5-3/4	6-3/4	9	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Pressure on material**, psi.	433 lbs.	410 lbs.	616 lbs.	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Cycles per hour**	- - -	- - -	- - -	- - -	- - -	- - -	- - -	720	720	420
Speeds, inches/minute: Closing	- - -	- - -	- - -	435	435	468	456	- - -	- - -	300
Opening	- - -	- - -	- - -	408	325	360	360	- - -	- - -	300
Platens or molds: Size (max.), inches	12½x12½	18½x18½	24½x24½	24 x 20	24 x 20	30 x 24	36 x 30	11½x6	10x6	15x13
Number of platens	2 - 3	2 - 4	2 - 4	2	2	2	2	2	2	2
Daylight opening, in. (max.)	6	12	15	38	38	38	42	22½	20-3/4	28
Thickness (min.-max.)##, in.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Locking force, tons	50	70	125	100	150	200	300	25	- - -	- - -
Tie bars or rods: Diameter, inches	1#	1#	2#	3½	4	5	6	1½	1½	2½
Space between, inches	- - -	- - -	- - -	24x20	24x20	30x24	36x30	14-3/4 x	5½ →	19x11½
Material heating capacity, kw.	6	8	12	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Type of heating	Electric	Electric	Electric	Electric	Electric	Electric	Electric	Electric	Electric	Electric
Motor hp.	- - -	1½	3	15	20	20	30	- - -	2	7½
Approx. floor space (LxW), feet	1-1/3 x 2-1/12 (without stand)	2-1/6 x 2-1/6	- - -	10 x 8½	10 x 8½	10-2/3 x 9-1/2	11-1/3 x 10-1/3	2½ x 3	2 x 5	4 x 10 . .
Special features	(Same as above) →			Positive top & bottom ejection; indep. air hold-up or hold-down; insul. platens; integral part unloader; adj. hi-speed approach; adj. low-pressure close; oil cooler. →				Adj. drum feeder; air toggle operation;		

(continued on next page)

Manufacturer*	Pasadena (Cont'd)			Rodgers (Cont'd)				Stokes (Cont'd)		
Model number	B 240 Type	H8 Type	K-10-360 Model	TCMA-100-2420-10	TCMA-150-2420-20	TCMA-200-3624-10	TMCA-300-3630-10	725	800	741
Special features (continued)								Adj. cycle control; double-shot production. →		
									Pos. top or bottom ejection; preset loading boards; Pos. sequence control; low-pressure closing. →	
Optional features	(Same as preceding page)			Fully-adjustable breathe cycles; indicating temperature controls for platens, fully automatic preform heater & feeder. →				- - -	Breathe attachment.	Polyester rope feed or preform. Side-draw attachment.
									Powder preheating. →	
Approx. delivery time, weeks	- - -	- - -	- - -	- - -	- - -	- - -	- - -	2 - 4	2 - 4	2 - 4

Slab slides.

* Also available in 25-ton capacity.
** Also available in 50-, 150-, and 200-ton capacities.
*** Also available in 100-, 200-, and 300-ton capacities.
# Also available in 50-, 75-, and 200-ton capacities.
Also available in 50-, 100-, and 300-ton capacities.
Plus power unit.

Manufacturer*	Stokes (Cont'd)			Wabash
Model number	741 T	726	727	50-24M
Machine action	Auto.	Semi-auto.	Semi-auto.	Semi-auto.
Machine design type	Rod	Rod	Rod	- - -
Press capacity, tons: Compression	150#	200##	50###	50
Transfer	30	- - -	19	- - -
Casting area#, square inches	- - -	- - -	- - -	480
Ram or plunger: Stroke, inches	14 (C) 10 (T)	15	12	7
Diameter, inches	- - -	- - -	- - -	3-3/4
Pressure on material**, psi.	- - -	- - -	- - -	232
Cycles per hour**	360	- - -	- - -	- - -
Speeds, inches/minute: Closing	360	312	280	60
Opening	300	312	280	60
Platens or molds: Size (max.), inches	24 x 20	30 x 24	18 x 16	18 x 24
Number of platens	2	2	2	2
Daylight opening, inches (max.)	32	35	28	15
Thickness (min.-max.)##, in.	- - -	- - -	- - -	1-1½
Locking force, tons	150	- - -	50	50
Tie bars or rods: Diameter, inches	3½	4	2-3/4	1-3/4
Space between, inches	28x14½	36 x 12	22½x7-3/4	8½x27
Material heating capacity, kw.	- - -	- - -	- - -	9
Type of heating	Electric	- - -	- - -	Electric
Motor hp.	15	7½	5	3/4
Approx. floor space (LxW), feet	4 x 10½	4 x 2###	2½x1½###	2-1/6x2-1/6
Special features	Auto. cycle controllers; 3-speed closing.			Transitorized temp. control.
	Convertability to top transfer; Mechanical top & bottom ejectors. →			
Optional features	Lo-pressure closing; heating platens; mold heating & chilling. Powder preheating. →			Water-cooled platens.
			Available as bottom transfer.	
Approx. delivery time, weeks	2 - 4	2 - 4	2 - 4	8 - 12

Custom-Made To Order

Adamson United Co.

All types of presses (automatic, semi-auto. and manual) built to customers' specifications. Compression and transfer presses built in sizes from 50-tons up and working areas from 12 x 12-inches up; with ram sizes and strokes, working pressures, and press controls to customers' requirements. Design types include rod, side plate, window-frame, barrel, and special types.

Atlas Hydraulics Div.

Compression molding, transfer molding, laminating, and special-application presses built as self-contained units or for use with central hydraulic systems.

Stewart Bolling & Co., Inc.

Compression and transfer presses to customers' specifications can be furnished.

Custom Machine & Design, Inc.

Multiframe presses are built to meet customers' requirements--semi-auto. or automatic to any capacity, ram diameter and stroke, and platen size or opening desired.

Dake Corp.

Guided-platen presses in capacities from 25-600 tons.

Dunning & Boschert Press Co., Inc.

Semi-auto. presses made in ram sizes from 8-24 inches, with tonnages (at 3,000 psi. line pressure) from 75-679. Optional features include transfer cylinders, top and bottom ejection, steam or electric heating, and degassing.

Erie Foundry Co.

Presses & design types available up to 2,000 tons.

French Oil Mill Machinery Co.

Semi-auto. & manual compression & transfer molding presses made in rod-type & side-plate designs in capacities from 30-2,000 tons, either self-contained or accumulator-operated.

Hull-Standard Corp.

In addition to tabulated models, also makes special molding presses in sizes from 10-500 tons.

Hydraulic Press Mfg. Co.

In addition to tabulated models, also builds larger presses to customers' specifications. Also makes special loaders & other auxiliary equipment to order.

Pasadena Hydraulics, Inc.

In addition to tabulated units, also make transfer presses, and custom-made presses to 600 tons.

PT's Classified List of Auxiliary Equipment for Thermoforming and Compression and/or Transfer Molding

Accumulators

Adamson United Co., 730 Carroll Street, Akron 4, Ohio
Airmatic Valve, Inc., 7313 Associate Avenue, Cleveland 9, Ohio
Baldwin-Lima-Hamilton Corp., Philadelphia National Bank Bldg., Phila. 7, Pa.
Blaw-Knox Co., 300 Sixth Ave., Pittsburgh 22, Pa.
Dunning & Boschert Press Co., Inc., 331 W. Water St., Syracuse 2, N.Y.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
French Oil Mill Machinery Co., 1040 W. Greene St., Piqua, Ohio
Greer Hydraulics, Inc., N.Y. International Airport, Jamaica 30, New York
Karlton Machinery Corp., 210 E. Ohio St., Chicago 11, Ill. (Rep. for Becker & Van Hullen)
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Lake Erie Machinery Corp., Post Office Box 68, Buffalo 17, New York
Lembo Machine Works, Inc., 248 E. 17th St., Paterson 4, N.J.
Miller Fluid Power Div., Flick-Reedy Corp., 7N015 York Rd., Bensenville, Ill.
Mount Hope Machinery Co., 15 Fifth Street, Taunton, Mass.
Ralph B. Symons Associates, Inc., 3571 Main Rd., Tiverton, R.I.
Waldron-Hartig Div., Midland-Ross Corp., P.O. Box 791, River Rd., New Brunswick, N.J.

Tumbling Barrels

Abbe Engineering Co., 420C Lexington Ave., New York 17, New York.
Acme Machinery & Mfg. Co., Inc., 20 South Broadway, Yonkers 2, New York
Continental Machinery Co., Inc., 261 Broadway, New York 7, New York
Crown Machinery, Inc., 2721 S. San Pedro St., Los Angeles 11, Calif.
Ferry Machine Co., W. Main St. Ext., Kent, Ohio
Injection Molders Supply Co., 3514 Lee Road, Cleveland 20, Ohio
H. W. Kramer Co., Inc., 120-30 Jamaica Avenue, Richmond Hill 18, N.Y.
Lord Chemical Corp., 2068 S. Queen Street, York, Pa.
Lupoline Automatic Polishing Equipment Corp., Bronx 70, N.Y. (4510 Bullard Avenue)
Morse Mfg. Co., Inc., 727 W. Manlius St., E. Syracuse, N.Y.
Omni Products Corp., 460 Fourth Avenue, New York 16, New York
Rampe Mfg. Co., Cleveland 10, Ohio (14915 Woodworth Avenue)
Ransohoff Co., N. 5th St. & Ford Blvd., Hamilton, Ohio
The R. R. Siebert Co., 183 St. Paul St., Rochester, N.Y.
Techline Div., Wheelabrator Corp., 1414 Avenue V, Vicksburg, Mich.
Tower Iron Works, Inc., 50 Borden Street, Providence, R.I.
Tumb-L-Matic, Inc., St. Mary's St., Stamford, Conn.

Controlling Instruments, Press Cycling

Eagle Signal Corp., 202-20th St., Moline, Ill.
Electronic Process Corp. of California, 436 Bryant, San Francisco 7, Calif.
Foster & Allen, Inc., 26 Commerce St., Chatham, N.J.
The Foxboro Company, 38 Neponset Ave., Foxboro, Mass.
GPE Controls Inc., 240 E. Ontario St., Chicago 11, Ill.
General Electric Co., Apparatus Sales Div., 1 River Rd., Schenectady 5, N.Y.
Glenn Electric Heater Corp., 372 Jelliff Ave., Newark 8, N.J.
Minneapolis-Honeywell Regulator Co., 2753 Fourth Ave. S., Minneapolis 8, Minn.
Partlow Corporation, 225 Campion Rd., New Hartford, N.Y.
Plastics by Chapmann, 1220 S. 49th St., Richmond, Calif.
Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio
Taylor-Emmett Controls, Inc., 445 E. Turkeyfoot Lake Rd., Akron 19, Ohio
Taylor Instrument Companies, 95 Ames St., Rochester 1, N.Y.
Wallace & Tiernan, Inc., 25 Main Street, Belleville 9, N.J.
G. C. Wilson & Co., 1915 Eighth Ave., Huntington, W. Va.

Controlling Instruments, Pressure

Fischer & Porter Co., 30 Warminster Rd., Hatboro, Pa.
The Foxboro Co., 38 Neponset Ave., Foxboro, Mass.
GPE Controls Inc., 240 E. Ontario St., Chicago 11, Ill.
Gabriel Mfg. Co., 15 Maple Ave., Haverstraw, N.Y.
General Electric Co., Apparatus Sales Div., 1 River Rd., Schenectady 5, N.Y.
Helicoid Gage Div., American Chain & Cable, 929 Connecticut Ave., Bridgeport 2, Conn.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia 44, Pa.
Leslie Co., 214 Leslie Bldg., Lyndhurst, N.J.
Minneapolis-Honeywell Regulator Co., 2753 Fourth Ave. S., Minneapolis 8, Minn.
Powers Regulator Co., 3400 Oakton St., Skokie 34, Ill.
Taylor Instrument Companies, 95 Ames St., Rochester 1, N.Y.
United Electric Controls Co., 85 School St., Watertown 72, Mass.
Weston Instruments, Div. of Daystrom, Inc., 614 Frelinghuysen Ave., Newark 12, N.J.

Controlling Instruments, Temperature

Barber-Colman Co., Wheelco Instruments Div., 1300 Rock St., Rockford, Ill.
Electric Auto-Lite Co., General Products Group, Champlain, Toledo 1, Ohio
Electronic Processes Corp. of California, 436 Bryant, San Francisco 7, Calif.
Fenwal, Inc., Pleasant St., Ashland, Mass.
Fischer & Porter Co., 30 Warminster Rd., Hatboro, Pa.
The Foxboro Co., 38 Neponset Ave., Foxboro, Mass.
General Electric Co., Apparatus Sales Div., 1 River Rd., Schenectady 5, N.Y.
Glenn Electric Heater Corp., 372 Jelliff Ave., Newark 8, N.J.
Industrial Mfg. Corp., 31 E. Georgia St., Indianapolis 4, Ind.
Jones Motrola Corp., 432 Fairfield Ave., Stamford, Conn.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia 44, Pa.
Leslie Co., 214 Leslie Bldg., Lyndhurst, N.J.
Mayer Refrigerating Engineers, Inc., Boonton Turnpike, Lincoln Park, N.J.
Minneapolis-Honeywell Regulator Co., 2753 Fourth Ave. S., Minneapolis 8, Minn.
Partlow Corp., 225 Campion Rd., New Hartford, N.Y.
The Powers Regulator Co., 3400 Oakton St., Skokie 34, Ill.
Pyrometer Instrument Co., Inc., 92 Portland St., Bergenfield, N.J.
Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio
Sarco Co., Inc., 635 Madison Avenue, New York 22, N.Y.
Sterling, Inc., 520 W. Clinton Ave., Milwaukee, Wis.
Taylor Instrument Companies, 95 Ames St., Rochester 1, N.Y.
Thermo Electric Co., Inc., 109 Fifth St., Saddle Brook, N.J.
Thwing-Albert Instrument Co., 5398 Pulaski Ave., Philadelphia 4, Pa.
United Electric Controls Co., 85 School St., Watertown 72, Mass.
West Instrument Corp., 4263 W. Montrose Ave., Chicago 41, Ill.

Cylinders, Hydraulic

Airmatic Valve, Inc., 7313 Associate Avenue, Cleveland 9, Ohio
Airoyal Mfg. Co., 1990 Springfield Avenue, Maplewood, N.J.
Automatic Process Control, 1170 Morris Avenue, Union, N.J.
The Bellows Co., 230 West Market Street, Akron 9, Ohio
Clifton Hydraulic Press Co., 289 Alwood Road, Clifton, N.J.
Dake Corporation, 641 Robbins Road, Grand Haven, Mich.
Dunning & Boschert Press Co., Inc., 331 W. Water St., Syracuse 2, New York
The French Oil Mill Machinery Co., 1040 West Greene St., Piqua, Ohio
Hanna Engineering Works, 1767 Elston Ave., Chicago 22, Illinois
Hannifin Co., Div. of Parker-Hannifin Corp., 554D S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Marion Rd., Mt. Gilead, Ohio
Independent Machine Co., Munroe Falls Ave., Cuyahoga Falls, Ohio
Lapeer Mfg. Co., 1149 W. Baltimore St., Detroit 2, Michigan
The C. A. Lawton Co., 233 N. Broadway, DePere 1, Wisconsin
Lembo Machine Works, Inc., 248 E. 17th St., Paterson 4, N.J.
Lempco Industrial, Inc., 5490 Dunham Rd., Bedford, Ohio
Logan Hydraulics, Inc., 4901 W. Lawrence Ave., Chicago 30, Ill.
Miller Fluid Power Div., Flick-Reedy Corp., 7N015 York Rd., Bensenville, Ill.
The Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wisconsin
Rodgers Hydraulic, Inc., 7401 Walker St., Minneapolis 26, Minn.
Valvair Corp., 220 W. Market Street, Akron 3, Ohio

Deflashing Machines

Anson Tools & Gages, Inc., 1504 W. 12th Street, Erie, Pa.
Buttondex Corporation, 386 Fourth Avenue, New York 16, New York
Falls Engineering & Machine Co., 1734 Front Street, Cuyahoga Falls, Ohio

Ferry Machine Co., West Main Street Extension, Kent, Ohio
Foredom Electric Co., Inc., Bethel, Connecticut
Gaynes Engineering Co., 1642 W. Fulton St., Chicago 12, Ill.
Ketchpel Engineering Co., 1401-04 Palisade Avenue, W. Englewood, New Jersey
H. W. Kramer Co., Inc., 120-30 Jamaica Avenue, Richmond Hill 18, N.Y.
Lord Chemical Corp., 2068 S. Queen Street, York, Pennsylvania
Lupoline Automatic Polishing Equipment Corp., 4510 Bullard Ave., Bronx 70, New York
Merit Products, Inc., 3691 Lenawee Ave., Los Angeles 16, Calif.
J. M. Nash Co., Inc., 2360 N. 30th St., Milwaukee 45, Wis.
Ransohoff Co., N. 5th St. & Ford Blvd., Hamilton, Ohio
The R. R. Siebert Co., 183 St. Paul St., Rochester, N.Y.
Techline Div., Wheelabrator Corp., 1414 Avenue V, Vicksburg, Mich.
Tumb-L-Matic, Inc., St. Mary's St., Stamford, Conn.
Wheelabrator Corporation, 1414 S. Byrkit St., Mishawaka, Ind.

Degating Equipment

Anson Tools & Gages, Inc., 1504 W. 12th Street, Erie, Pa.
Barker-Davis Machine Co., Inc., 91 Mechanic Street, Leominster, Mass.
Buss Machine Works, Inc., 300 Eighth Street, Holland, Michigan
Buttondex Corporation, 386 Fourth Avenue, New York 16, New York
Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio
The C. A. Lawton Co., 233 N. Broadway, DePere 1, Wisconsin
Plastic Molders Supply Co., Inc., 74 South Avenue, Fanwood, New Jersey
Standard Tool Co., 203 Hamilton Street, Leominster, Mass.
Sta-Warm Electric Co., 858 N. Chestnut Street, Ravenna, Ohio
Stricker-Brunhaber Corp., 19 W. 24th St., New York 10, New York
Techline Div., Wheelabrator Corp., 1414 Avenue V, Vicksburg, Mich.

Dies, Cutting

A & S Steel Rule Die Corp., 195 Chrystie Street, New York 2, N.Y.
Able Steel Rule Die Co., 65 Bleecker St., New York 12, N.Y.
Accurate Steel Rule Die Mfrs., 22 West 21st St., New York 10, N.Y.
Akron Presform Mold Co., 2038 Main St., Cuyahoga Falls, Ohio
Atlas-Sandt Corp., 240-42 West 23 St., New York 11, New York
Blaw-Knox Co., 300 Sixth Avenue, Pittsburgh 22, Pennsylvania
Crucible Steel Co. of America, P.O. Box 2518, Pittsburgh 30, Pennsylvania
Entoleter Div., Safety Industries, Inc., 1187 Dixwell Ave., New Haven, Conn.
Falls Engineering & Machine Co., 1734 Front Street, Cuyahoga Falls, Ohio
G & S Label Corp., 49 West 27 Street, New York 1, N.Y.
Independent Die & Supply Co., 2641 La Salle St., St. Louis 4, Mo.
Lansky Die Cutting Corp., 473 President Street, Brooklyn 15, New York
Payne Tool & Engineering Co., 1300 W. Columbia St., Springfield, Ohio
J. A. Richards Co., 903 N. Pitcher St., Kalamazoo, Mich.
S. Todaro Co., 52 Trinity Place, Buffalo 1, N.Y.
Tronomatic Machine Mfg. Corp., 1881 Park Avenue, New York 35, New York
United Shoe Machinery Corp., 140 Federal St., Boston 7, Mass.
Western Supplies Co., 2920 Cass Avenue, St. Louis 6, Mo.

Heating Equipment for Molds

American Hydrotherm Corp., 10-55 Jackson Avenue, Long Island City 1, New York
Blaw-Knox Co., 300 Sixth Avenue, Pittsburgh 22, Pennsylvania
E. B. Blue Co., 651 Connecticut Avenue, S. Norwalk, Conn.
Briscoe Mfg. Co., 1055 Gibbard Ave., Columbus 3, Ohio
Clifton Hydraulic Press Co., 289 Alwood Road, Clifton, N.J.
Conapac Corp., 120 East 13 Street, New York 3, N.Y. (U.S. & Canadian Dist. for Hydro-Chemie Ltd.)
D. C. Cooper Co., 1467 S. Michigan Ave., Chicago 5, Ill.
Dean Thermo-Panel Coil Div., Dean Products, Inc., 616 Franklin Ave., Brooklyn 38, N.Y.
Devco Engineering, Inc., Peir Lane, W. Caldwell, N.J.
Electric Trading Co., 313-315 Canal Street, New York 13, New York
Erinac Equipment Corp., 225 Lafayette St., New York 12, N.Y.
Falcon Equipment Co., 13th Street, New Brighton, Pa.
General Electric Co., Apparatus Sales Div., 1 River Road, Schenectady 5, N.Y.
Gerin Mfg. Inc., 683-685 N. 5th St., Newark 7, N.J.
Glenn Electric Heater Corp., 372 Jelliff Avenue, Newark 8, N.J.
Grieve-Hendry Co., Inc., 1401 W. Carroll Ave., Chicago 7, Ill.
Guild Electronics, Inc., Dynatherm Div., 388 Broadway, New York 13, New York
Hotwatt, Inc., 75 Maple St., Danvers, Mass.
Improved Machinery, Inc., 150 Burke St., Nashua, N.H.
Industrial Heater Co., Inc., 417 Canal St., New York 13, N.Y.
Industrial Mfg. Corp., 31 E. Georgia St., Indianapolis 4, Ind.
Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio
Mercury Molding Machinery, Inc., 972 Nepperhan Ave., Yonkers, N.Y.
Omni Products Corp., 460 Fourth Avenue, New York 16, N.Y.
Pantex Mfg. Corp., 520 Roosevelt Avenue, Pawtucket, R.I.
Powers Regulator Co., 3400 Oakton St., Skokie 34, Ill.
The Rainville Co., Inc., 657 Franklin Avenue, Garden City, New York
Robbins Plastic Machinery Corp., 1430 Mishawaka St., Elkhart, Ind.
W. S. Rockwell Co., 20 Elliot St., Fairfield, Conn.
Sterling, Inc., 5200 W. Clinton Avenue, Milwaukee, Wis.
Thermel, Inc., 9400 Robinson Rd., Franklin Park, Ill.

Lubricating Systems

Bijur Lubricating Corp., 151 W. Passaic St., Rochelle Park, N.J.
Lincoln Engineering Co., 4010 Goodfellow, St. Louis 20, Mo.
Mercury Molding Machinery, Inc., 972 Nepperhan Ave., Yonkers, N.Y.

Marking Equipment

The Acromark Co., 5-13 Morrell St., Elizabeth 4, N.J.
Defiance Machine & Tool Co., 1920 S. Vandeventer Ave., St. Louis 10, Mo.
Halvorfold Kwikprint Co., 700 E. Union, Jacksonville, Fla.
James H. Matthews & Co., 3829 Forbes Ave., Pittsburgh 13, Pa.
Olsenmark Corp., 124-132 White St., New York 13, N.Y.
Skyline Industries, Titusville, Pa.

Metal Detectors and Separators

E. W. Brilmayer Laboratories, Inc., 86 Fulton St., New York 38, N.Y.
Carpco Mfg. Inc., 4120 Haines St., Jacksonville 6, Fla.
Crucible Steel Co. of America, P.O. Box 2518, Pittsburgh 30, Pa.
Magnetic Engineering & Mfg. Co., 851 Van Houten Ave., Clifton, N.J.
Plastic Molders Supply Co., Inc., 74 South Avenue, Fanwood, N.J.
Radio Corp. of America, Front & Cooper Sts., Camden 2, N.J.
Rainville Co. Inc., 657 Franklin Avenue, Garden City, N.Y.

Mold Chillers

Al-Be Industries, 9516 Rayo St., South Gate, Calif.
Anson Tools & Gages, Inc., 1504 W. 12th St., Erie, Pa.
Artisan Metal Products, Inc., 63 Pond Street, Waltham 54, Mass.
Blaw-Knox Co., 300 Sixth Avenue, Pittsburgh 22, Pa.
Dean Thermo-Panel Coil Div., Dean Products, Inc., 616 Franklin Avenue, Brooklyn 38, N.Y.
Frank W. Egan & Co., 671 S. Adamsville Rd., Somerville, N.J.
Electric Trading Co., 313-315 Canal St., New York 13, N.Y.
Gerin Mfg. Co., Inc., 683-685 N. 5th St., Newark 7, N.J.
Goulding Mfg. Co., 2929 River St., Saginaw, Mich.
Industrial Ovens, Inc., 13825 Triskett Rd., Cleveland 11, Ohio
Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio
L & P Tool Co., 2861 Sidney Ave., Cincinnati 25, Ohio
Lembo Machine Works, Inc., 248 E. 17th St., Paterson 4, N.J.
Liberty Machine Co., Inc., 275 Fourth Avenue, Paterson 4, N.J.
Mayer Refrigerating Engineers, Inc., Boonton Turnpike, Lincoln Park, N.J.
Mercury Industries, Inc., 365 Broadway, Hillsdale, N.J.
Mercury Molding Machinery, Inc., 972 Nepperhan Avenue, Yonkers, N.Y.
Modern Plastic Machinery Corp., 15 Union St., Lodi, New Jersey
Motch & Merryweather Machinery Co., 1258 E. 222nd St., Cleveland 17, Ohio
National Rubber Machinery Co., Plastics Machinery Div., 47 W. Exchange St., Akron 8, Ohio
Omni Products Corp., 460 Fourth Avenue, New York 16, N.Y.
Pecorp, Inc., Basin Rd., P.O. Box 3164, Wilmington 4, Del.
The Rainville Co., Inc., 657 Franklin Ave., Garden City, N.Y.
Saren, Inc., 816 N. Kostner Ave., Chicago 51, Ill.
T. Shriver & Co., Inc., 808 Hamilton St., Harrison, N.J.
Sterling, Inc., 5200 W. Clinton Ave., Milwaukee, Wis.
Tenney Engineering, Inc., 1090 Springfield Rd., Union, N.J.
John Verduin Machine Corp., 345-357 Tenth Ave., Paterson 4, N.J.
Vic Mfg. Co., 1313 Hawthorne Ave., Minneapolis, Minn.
John Waldron Corp., P.O. Box 791, River Rd., New Brunswick, N.J.
Wilkinson Co., 619 E. Tallmadge Ave., Akron 10, Ohio

Mold Components, Standard

Crucible Steel Co. of America, P.O. Box 2518, Pittsburgh 30, Pa.
Damen Tool & Engineering Co., Inc., 4621-4627 N. Olcott Ave., Chicago 31, Ill.
Detroit Mold Engineering Co., 6686 E. McNichols Rd., Detroit, Mich.
National Tool & Mfg. Co., 100 N. 12th St., Kenilworth, N.J.
Omni Products Corp., 460 Fourth Avenue, New York 16, N.Y.
The Van Dorn Iron Works Co., 2685 East 79th St., Cleveland, Ohio

Molds

ABA Tool & Die Co., Inc., 1395 Tolland Turnpike, Manchester, Conn.
Akron Presform Mold Co., 2038 Main St., Cuyahoga Falls, Ohio
Astor Tool & Die Co., 5-01 47th Rd., Long Island City 1, New York
B & E Electroform Co., Greely Ave., Union, N.J.
Bart Manufacturing Corp., 227 Main St., Belleville 9, N.J.
Beacon Die-Mold, Inc., 57 Crooks Ave., Clifton, N.J.
Blackhawk Molding Co., Inc., Commercial Rd., Addison, Ill.
Conforming Matrix Corp., Toledo Factories Bldg., Toledo 2, Ohio

Damen Tool & Engineering Co., Inc., 4621-4627 N. Olcott Ave., Chicago 31, Ill.
Electroforms, Inc., 239 E. 165 St., Gardena, Calif.
Electromold Corporation, 140 Enterprise Ave., Trenton 9, N.J.
Geneve Mfg. Corp., 288 Third St., Trenton, N.J.
Hartland Plastics Inc., 340 Maple Ave., Hartland, Wis.
T. V. Jay Co., 2227 W. Belmont Ave., Chicago 18, Ill.
Liberty Tool & Machinery Co., 18 S. 20th St., Irvington 11, N.J.
Ernest Mueller, 125 N. Detroit St., Los Angeles 36, Calif.
Oak Engineering Co. Inc., 110 Monmouth St., Gloucester City, N.J.
Pasley's Plastic Products, Inc., 1275 Ellsworth Industrial Dr., N.W., Atlanta 18, Ga.
Planet Plating Co., Inc., 494 Morgan Ave., Brooklyn 22, N.Y.
Plastic Mold Tool & Die Co., Inc., 1 Maple Street, E. Rutherford, N.J.
Plastiplate Co., Inc., 7-9 Holmes Ave., S. River, N.J.
Plating Engineering Co., 1928 S. 62nd St., Milwaukee 19, Wis.
Reinhardt Plastics Co., 1611-15 Platte St., Denver 2, Colo.
Rochelle Plastic Mold Co., Inc., 35 Sebago St., Clifton, N.J.
Sawaya Mfg. Co., Inc., 305 State St., Trinidad, Colo.
Sierra Electric Corp., 15100 S. Figueroa, Gardena, Calif.
Stokes-Trenton, Inc., 150 Enterprise Ave., Trenton 9, N.J.
Timely Products Co., 308 Rogers Rd., Des Moines 15, Iowa
Ultra Electroforming & Mfg., 110 Cedar Ave., Pitman 7, N.J.

Motors

Allis-Chalmers Mfg. Co., 1163 S. 70th St., Milwaukee 1, Wis.
General Electric Co., Apparatus Sales Div., 1 River Road, Schenectady 5, New York
Induction Motors Corp., 570 Main Street, Westbury, New York
Modern Plastic Machinery Corp., 15 Union St., Lodi, N.J.
The Oilgear Co., 1560 Pierce St., Milwaukee 4, Wisconsin
Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles 22, Calif.

Platens, Press

Adamson United Co., 730 Carroll Street, Akron 4, Ohio
P. E. Albert & Son, 21 Nottingham Way, Trenton 3, N.J.
Atlantic Mfg. Co., Ninth & Master Sts., Philadelphia 22, Pa.
Baldwin-Lima-Hamilton Corp., Philadelphia National Bank Bldg., Philadelphia 7, Pa.
Berthelsen Engineering, P.O. Box 1423, Joliet, Ill.
Birdsboro Steel Foundry & Machine Co., 1951 Furnace St., Birdsboro, Pa.
E. W. Bliss Co., 1375 Raff Rd., S.W., Canton 10, Ohio
Bolling, Stewart & Co., Inc., 3190 E. 65th St., Cleveland 27, Ohio
Fred S. Carver, Inc., 1 Chatham Rd., Summit, N.J.
Clifton Hydraulic Press Co., 289 Alwood Rd., Clifton, N.J.
Custom Engineering Co., 2414 McKinley Ave., Erie, Pa.
Dake Corp., Grand Haven, Mich.
Dunning & Boschert Press Co., Inc., 331 W. Water St., Syracuse 2, N.Y.
Erie Engine & Mfg. Co., 953 E. 12th St., Erie, Pa.
Falcon Equipment Co., 13th St., New Brighton, Pa.
French Oil Mill Machinery Co., 1040 W. Greene St., Piqua, Ohio
Johnson Machinery Co., 683 Frelinghuysen Ave., Newark 5, N.J.
Karlton Machinery Corp., 210 E. Ohio St., Chicago 11, Ill. (Rep. for Becker & Van Hullen)
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Lake Erie Machinery Corp., P.O. Box 68, Buffalo 17, N.Y.
The C. A. Lawton Co., 233 N. Broadway, DePere 1, Wisconsin
Lempco Industrial, Inc., 5490 Dunham Rd., Bedford, Ohio
The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Logan Hydraulics, Inc., 4901 W. Lawrence Ave., Chicago 30, Ill.
M & N Hydraulic Press Co., Inc., P.O. Box 504, Clifton, N.J.
Pasadena Hydraulics, Inc., 1433 Lidcombe, El Monte, Calif.
Plastic Laminating Corp., 2087 Springfield Ave., Vauxhall, N.J.
Reliable Rubber & Plastic Machinery Co., Inc., 2014 Union Turnpike, N. Bergen, N.J.
Roehlen Engraving Works, 324 St. Paul St., Rochester 5, N.Y.
Ralph B. Symons, Associates, Inc., 3571 Main Road, Tiverton, R.I.
Thermel, Inc., 9400 Robinson Rd., Franklin Park, Ill.
John Verduin Machine Corp., 345-357 Tenth Ave., Paterson 4, N.J.
Willson Camera Co., 1395 Lawrence Rd., Havertown, Pa.
R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.

Power Systems, Hydraulic

Berthelsen Engineering, P.O. Box 1423, Joliet, Ill.
Clifton Hydraulic Press Co., 289 Alwood Road, Clifton, New Jersey
Consolidated Baling Machine Co., 408-L Third Avenue, Brooklyn 15, New York
Continental Machinery Co., Inc., 261 Broadway, New York 7, New York
Dake Corp., 641 Robbins Rd., Grand Haven, Mich.
Erie Engine & Mfg. Co., 953 E. 12th St., Erie, Pa.
The French Oil Mill Machinery Co., 1040 W. Greene St., Piqua, Ohio
GPE Controls, Inc., 240 E. Ontario St., Chicago 11, Ill.
Goulding Mfg. Co., 2929 River St., Saginaw, Michigan
Greer Hydraulics, Inc., N.Y. International Airport, Jamaica 30, N.Y.
Hannifin Co., Div. of Parker-Hannifin Corp., 554D S. Wolf Rd., Des Plaines, Ill.
Guy P. Harvey & Son Corp., 40 Spruce St., Leominster, Mass.
Hull Standard Corp., Hatboro, Pa.
The Hydraulic Press Mfg. Co., Marion Rd., Mt. Gilead, Ohio
Johnson Machinery Co., 683 Frelinghuysen Ave., Newark 5, N.J.
Kabar Mfg. Corp., 1907 White Plains Rd., New York 62, New York
Karlton Machinery Corp., 210 E. Ohio St., Chicago 11, Ill. (Rep. for Becker & Van Hullen)
The C. A. Lawton Co., 233 N. Broadway, DePere 1, Wis.
Logan Hydraulics Inc., 4901 W. Lawrence Ave., Chicago 30, Ill.
Mayflower Electronic Devices Inc., Little Ferry, N.J., 20 Industrial Avenue
The Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Possis Machine Corp., 1645 Hennepin Ave., Minneapolis 3, Minn.
Racine Hydraulics & Machinery, Inc., 2000 Albert St., Racine, Wis.
Rodgers Hydraulic Inc., 7401 Walker St., Minneapolis 26, Minn.
Stanford Engineering Co., Box 329, Salem, Ill.
Ralph B. Symons Assoc. Inc., 3571 Main Road, Tiverton, R.I.
R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.

Preformers

The Bonnot Co., 722 Mulberry Ave., S.E., Canton 2, Ohio
Arthur Colton Co., Div. of Snyder Corp., 3400 E. Lafayette St., Detroit 7, Mich.
Logan Hydraulics, Inc., 4901 W. Lawrence Ave., Chicago 30, Ill.
Rodgers Hydraulics, Inc., 7401 Walker St., Minneapolis 16, Minn.
F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa.
Ralph B. Symons Associates, Inc., 3571 Main Rd., Tiverton, R.I.

Preheating Equipment

Allis-Chalmers Mfg. Co., 1163 S. 70th St., Milwaukee 1, Wis.
D. C. Cooper Co., 1467 S. Michigan Avenue, Chicago 5, Ill.
Faratron, 447 Union Pacific Avenue, Los Angeles 23, Calif.
Girdler Process Equipment Div., Chemetron Corp., 334 E. Broadway, Louisville 1, Ky.
Guild Electronics Inc., Dynatherm Div., 388 Broadway, New York 13, N.Y.
W. T. La Rose & Assoc., Inc., Troy, New York
Mayflower Electronic Devices, Inc., 20 Industrial Avenue, Little Ferry, N.J.
Plastic Welding Corp., 780 Frelinghuysen Ave., Newark 12, N.J.
Radio Frequency Co., Inc., 44 Park Street, Medfield, Mass.
The Rainville Co., Inc., 657 Franklin Avenue, Garden City, N.Y.
Raybond Electronics, Inc., 66 Needham Street, Newton 61, Mass.
Reeve Electronics, Inc., 609 West Lake St., Chicago 6, Ill.
Sealomatic Electronics Corp., 429 Kent Avenue, Brooklyn 11, New York
Sherman Industrial Electronics, 601 West College Avenue, Box 813, State College, Pa.
Ralph B. Symons Associates, Inc., 3571 Main Road, Tiverton, R.I.
The Thermatron Co., Div. of Willcox & Gibbs Sewing Machine Co., 214 W. 39 St., New York 18, N.Y.
Timadco, Inc., 72 Jericho Turnpike, Mineola, New York
Young Bros. Co., 1823 Columbus Road, Cleveland 13, Ohio

Pulverizing Units

Paul O. Abbe, Inc., 257 Center Ave., Little Falls, N.J.
American Pulverizer Co., 1249 Macklind Ave., St. Louis 10, Missouri
Custom Machine & Design, Inc., P.O. Box 1064, 200 S. Forge St., Akron 9, Ohio
Entoleter Div., Safety Industries, Inc., 1187 Dixwell Ave., New Haven, Conn.
Ferro Corp., Patterson Equipment Div., E. Liverpool, Ohio
First Machinery Corp., 209-289—10th St., Brooklyn 15, N.Y.
Johnson Machinery Co., 683 Frelinghuysen Ave., Newark 5, N.J.
Franklin P. Miller & Son, Inc., 36 Meadow St., E. Orange 16, N.J.
Munson Mill Machinery Co., 210 Seward Ave., Utica 1, N.Y.
Pulva Corp., 550 High St., Perth Amboy, N.J.
Pulverizing Machinery Div., Metals Disintegrating Co., Inc., 30 Chatham Rd., Summit, N.J.
The Rainville Co., 657 Franklin Ave., Garden City, N.Y.
Charles Ross & Son Co., 148 Classon Ave., Brooklyn 5, N.Y.
Sturtevant Mill Co., 103 Clayton St., Boston, Mass.

Pumps, Hydraulic

Allis-Chalmers Mfg. Co., 1163 S. 70th St., Milwaukee 1, Wis.
Baldwin-Lima-Hamilton Corp., Philadelphia National Bank Bldg., Philadelphia 7, Pa.
Berthelsen Engineering, P.O. Box 1423, Joliet, Ill.
John Dusenbery Co., Inc., 271 Grove Ave., Verona, N.J.
Farrel-Birmingham Co., Inc., Watson-Stillman Press Div., 565 Blossom Rd., Rochester 10, N.Y.
French Oil Mill Machinery Co., 1040 W. Greene St., Piqua, Ohio
Hydraulic Press Mfg. Co., Marion Rd., Mt. Gilead, Ohio
Johnson Machinery Co., 683 Frelinghuysen Ave., Newark 5, N.J.
King Machine Tool Div., American Steel Foundries, 1150 Tenessee Ave., Cincinnatti 29, O.
Lincoln Engineering Co., 4010 Goodfellow, St. Louis 20, Mo.
Manton-Gaulin Mfg. Co., Inc., 44 Garden St., Everett 49, Mass.
The Oilgear Co., 1560 Pierce St., Milwaukee 4, Wisconsin

Racine Hydraulic & Machinery, Inc., 2000 Albert St., Racine, Wis.
Ralph B. Symons Associates, Inc., 3571 Main Rd., Tiverton, R.I.
Wallace & Tiernan, Inc., 25 Main Street, Belleville 9, N.J.
Worthington Corp., Harrison, N.J.

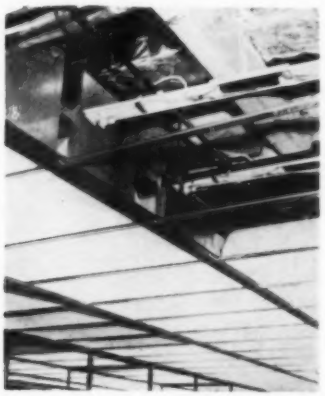
Tables, Elevating

Adamson United Co., 730 Carroll Street, Akron 4, Ohio
Bolling, Stewart & Co., Inc., 3190 E. 65th St., Cleveland 27, Ohio
Clifton Hydraulic Press Co., 289 Alwood Rd., Clifton, N.J.
Economy Engineering Co., 4511 W. Lake St., Chicago 24, Ill.
Erie Engine & Mfg. Co., 953 E. 12th St., Erie, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
French Oil Mill Machinery Co., 1040 W. Greene St., Piqua, Ohio
Hamilton Tool Co., 917 Hanover St., Hamilton, Ohio
Lewis-Shepard Products, Inc., 125 Walnut St., Watertown 72, Mass.
Mercury Industries, Inc., 365 Broadway, Hillsdale, N.J.

Tumbling Machines

Abbe Engineering Co., 420C Lexington Avenue, New York 17, N.Y.
Acme Machinery & Mfg. Co., Inc., 20 South Broadway, Yonkers 2, N.Y.
Ball & Jewell, Inc., 24-28 Franklin St., Brooklyn 22, N.Y.
Crown Machinery, Inc., 2721 S. San Pedro St., Los Angeles 11, Calif.
Ferro Corp., Patterson Equipment Div., E. Liverpool, Ohio
Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio
H. W. Kramer Co., Inc., 120-30 Jamaica Ave., Richmond Hill 18, N.Y.
Lupoline Automatic Polishing Equipment Corp., 4510 Bullard Ave., Bronx 70, N.Y.
Omni Products Corp., 460 Fourth Avenue, New York 16, N.Y.
Patterson-Kelley Co., Inc., E. Stroudsburg, Pa.
Rainco Mfg., Inc., R.D. #2, Franklin, Pa.
Ransohoff Co., No. 5th St. & Ford Blvd., Hamilton, Ohio
The R. R. Siebert Co., 183 St. Paul St., Rochester, N.Y.
Techline Div., Wheelabrator Corp., 1414 Avenue V, Vicksburg, Mich.
Tumb-L-Matic, Inc., St. Mary's St., Stamford, Conn.
Wheelabrator Corp., 1414 S. Byrkit St., Mishawaka, Ind.

—THE END



Exposed section of ceiling shows the duct system for air conditioning. Ceiling system, with and without diffusers. Note part of partition panel with clear glass at top.

Luminous Ceilings and Room Partitioning

One of the big advantages of luminous ceilings, in addition to their prime function of supplying uniform diffuse light, is to be found in large office spaces, where future requirements may call for many changes in room partitioning. This is dramatically brought out in Union Carbide Corp.'s new headquarters building in New York City, which utilizes a new "ceiling system" throughout.

The ceiling is actually a continuous plane of contiguous fixtures, which are hung independently and framed in place by a grid of cold-roll formed stainless steel runners: a major, or "A" runner, which supplies and returns conditioned air through its side groove; and the secondary, or "T" runner, also grooved. Partitions are keyed to the grooves, and may be erected anywhere on the basis of the 2½- by 5-foot module.

Still another purpose is served by the "ceiling system"—the blocking of sound traveling through the ceiling cavity. Each diffuser is provided with an aluminum frame and a polyurethane foam gasket-seal with a vinyl skin. This gasketing not only bars sound transmission, but prevents the leakage of light and dust.

Individual components of the system are also 2½- by 5-feet, and thus fit exactly into the predetermined module. Each uses a 40 watt fluorescent tube which supplies four watts per square foot. The light diffusion shields are thermoformed from Bakelite rigid vinyl (vinyl chloride-acetate copolymer) sheet which was calendered at high temperatures. Prior to forming, the sheeting was laminated from two 15-mil vinyl sheets with a one-mil Krene cast vinyl film on the inside facing the light source. A minimum of 50 foot candles of light are provided at desk level.

—THE END

Guest Editorial

J. L. MARZAK, *Mgr. of Market Research*
National Aniline Div.
Allied Chemical Corp.
New York, N. Y.

Look Around You—Polyurethane

ONE million pounds of polyurethane per day. That's the potential consumption if we look ahead at least five years. As a matter of fact, if trends continue along present lines, by 1965 we will be surrounded by polyurethane products.

To start with, the mattress we sleep on will probably be made of this versatile plastic foam. So will the seat cushion in the dinette chair, the seat of our car (or bus, subway, or railroad coach), perhaps even the underlay of the rugs on which we are likely to walk. Then there are automotive crash pads—already a very big item—and polyurethane solid tires, as well as noise-suppression devices such as typewriter pads, ceiling and wall tiles, and the like.

So far, only flexible foams have penetrated our daily environment to any degree. By 1965, they will probably account for some 250,000,000 pounds of polyurethane. Add to that another 100-million pounds going into rigid foam applications, and you begin to see another success story of the chemical and plastics industry.

Although isocyanate research in this country started some 20 years ago, it was not until about 1953 that the material was marketed with any degree of emphasis. Since then, many millions of dollars have been invested in research, development, and plant expansion. The year 1956 was the first in which one-million pounds of isocyanate were produced. We expect that five years from now potential consumption will be many times that amount.

How will this much isocyanate production be used? About 65% will end up as a flexible foam, and the other 35% will find its way into rigid foam, elastomer, adhesive, or coating applications.

If current indications are borne out, by 1962 most of the foam in automobiles will be polyurethane, displacing other materials now in use. Of particular significance is the development of molded products, and the likelihood that very soon entire seats will be foamed, possibly without springs, webbing, or any other supporting structures. The potential in this application and market alone is about 100,000,000 pounds of polyurethane by 1965.

Tremendous growth potential exists in the bedding field, also in excess of 100,000,000 pounds. Whereas latex mattresses now represent about 7-8% of the entire mattress market, molded and contoured polyurethane mattresses should soon account for a much larger share. They will be lower in price; they are impervious to soaps, detergents, and dry-cleaning; and are so easy to handle that turning them over for airing is no longer a struggle for the busy home-maker. They will be as light as the feathers in pillows—which may also be displaced by polyurethane.

A third field of major importance is furniture. Even now, polyurethane foam is used in seat cushions, arm rests, bolsters, and backing. Refinement in foam technology permits the furniture manufacturer to vary the density and feel of the foam to the customer's liking, and it won't be long before molded cushions, including crowns and fancy decoration, will be standard equipment. Because of these new developments, it is not unlikely that furniture applications for polyurethane foam will exceed 50-million pounds in another five years.

Incidentally, the foams we are talking about are based on the reaction between isocyanates and polyethers. The polyether types have captured the market almost completely, as they impart superior cushioning characteristics and are lower in cost.

Rigid foams are the other half of the family due for

some real growth. The first big-time application is in the field of thermal insulation: refrigerators. It is not too optimistic to assume that by about 1963 or 1964, saturation of the market will have been achieved, amounting to some 60-million pounds of insulation for home appliances and another 20-million pounds for industrial refrigerators. After that, there will be a noticeable leveling off in the growth curve of this market, a slight slope being due only to the normal population increase.

A second field which could become more important is construction, both residential and commercial. The use of sandwich panels containing rigid polyurethane foam definitely should increase. However, here we are faced with a number of variables, some of which cannot now be predicted accurately. Foremost among these is the matter of building codes. Plastics, in many instances, are at least as good if not better than wood or metal, and may often be much less expensive or easier to use. Therefore, if local and national authorities are willing to re-examine old-time philosophies in the light of myriads of potential benefits from these new materials, the building market may well require 100-million pounds of rigid polyurethane foam by 1965.

The figure is not overly optimistic. Right now, there are almost one million housing starts per year, not counting commercial establishments. If we consider that each house may require 500 pounds of polyurethane, and if only one out of every five will actually use the foam, that could mean 100-million pounds. To that may be added another 35-million as the potential for mobile homes, although only 10% of that is likely to be realized by 1965.

Isocyanates have, of course, applications other than flexible and rigid polyurethane foams. All told, coatings, elastomers, adhesives and potting compounds may well require an additional 25-million pounds of isocyanates. Other applications are being investigated.

In the coating field, maintenance coatings will no doubt play the most important role, followed (in order of volume) by wire, textile, and leather coatings. The significant factor in wire coatings is that the polyurethane need not be stripped; in fact, it acts like a flux. This is of tremendous value to the producer of electronic apparatus, who faces the delicate task of stripping an enamel from a wire which is thinner than a human hair.

Elastomer applications will largely be confined to industrial goods, such as belting for conveyors and V-belts, as well as for gaskets, hoses and tubing, and solid tires. In all these instances, the material will be selected because of its proven toughness, abrasion resistance, and ozone resistance. Auto tires, though much talked about, will likely come through only for trucks, taxis, or other fleet operations. Adhesives and potting compounds do not show the same scope as other polyurethane applications.

In 1965, the polyurethane world will likely be all around us. Surprising? Hard-to-believe? Not at all. It is just another example to show how the chemical and plastics industries are constantly striving to develop new products for the public—for you and for me.

—THE END

Testing Reinforced Plastics as Ablation Materials

Tube furnace used to test miniature nose cones.

The materials laboratory at Wright Air Development Center has completed a comprehensive investigation of the ablation properties of various reinforced plastic materials; ablation being defined as the ability of a material to undergo combined thermal-chemical-mechanical degradation with an attendant removal of surface material. This, in turn, thermally shields the material from the enviroment.

Materials tested include graphite compounds, phenyl-silane-glass, phenolic-ceramic fiber, phenolic-refrasil, epoxy-ceramic fiber, phenolic-asbestos, phenolic nylon, melamine-nylon, phenolic-asbestos-graphite, and silicone-asbestos. Cornell Aeronautical Laboratory built a graphite tube furnace for the study, designed specifically to simulate the environment of a body re-entering the atmosphere at hypersonic speed. Miniature nose cones were molded on a flat platen press and exposed to a high mass velocity gas (nitrogen) heated to 5,000° F., for 30 seconds.

The outer layer of the cones, which kept its pointed shape in the successful materials, becomes carbon from the original resin and glass fibers. Between the outside and the undamaged interior, the maximum temperature reached was 800-900° F., the point at which the resin begins to carbonize. During exposure, the surface remains at 3,500° F., (the melting point of the glass fiber reinforcement) even though the temperature was brought up to 15,000° F.

In addition to differences in materials tested, other parameters included percentage content, reinforcement type and percentage, ratio of resin to reinforcement, types of fillers and additives, and orientation of reinforcement.

PLASTICS TECHNOLOGY

EXPLORING FABRICATION TECHNIQUES

By L. J. ZUKOR, *Engineering Editor*

Polyester Resins . . .

. . . both saturated and unsaturated are being re-evaluated for an expanding market. Latest estimates set 150-170 million pounds for 1960, with continuous growth to almost 300 million pounds in the next five years. This renaissance is attributed to improved methods in fabrication, cheaper resins, and the introduction of new equipment such as the polyester, glass-roving type guns.

Two products account for most of the increased use of this material. These are boat hulls and sheet, both flat and corrugated. However, the growth of polyesters is not limited, and uses for this material fall into almost every category of manufactured goods from fishing rods to buttons and radomes. Polyesters are being used and evaluated in the automotive field for everything from truck cabs to whole body assemblies. The aircraft industry uses polyester glass laminates for ducting, structural members, and radar canopies.

In industry, where the polyesters are replacing metallic parts, still another requirement is being incorporated in specifications that already stipulate tensile strength, impact, and other physical and electrical requirements —namely, fire retardance. Many fabricators do not realize that standard polyesters support combustion, and will burn four times faster than oak. It is true that if a manufacturer is compression molding buttons and buckles, he need not worry about fireproofing his products. However, a manufacturer of boat hulls, truck cab bodies, automobile bodies, aircraft ducting, and glazing panels would have to think twice before using standard material for these applications. Here, he should investigate the use of fireproofing compounds which could be added to the resin mixture without impairing its physical and electrical properties. Compounds like antimony trioxide combined with a chlorinating agent have been used with some measure of success. However, there are disadvantages to be considered. For example, the addition of 1% antimony trioxide compound reduces light transmission by 50%.

Reinforced plastics fabricators could also investigate polyester resins derived from Het acid. This acid also known as chlorendic acid (hexachloroendomethylene tetrahydrophthalic anhydride), was first synthesized by Velsicol, Inc., 13 years ago. Three years later, in 1951, the Hooker Chemical Corp. discovered that it could be esterified in much the same way as phthalic anhydride. Resins prepared from Het acid have physical properties similar to standard polyesters and, in addition, are flame resistant and self-extinguishing.

Many processors that fabricate polyester laminates also do their own compounding. They purchase the basic unsaturated polyester resin, fillers, glass cloth, roving and other fibres, liquid monomer, and catalysts. The resin is first mixed with the liquid monomer, usually styrene. To this, a metal naphthanate accelerator may be added to promote setting at room temperature. Just prior to use, the compound is mixed with a peroxide-type catalyst.

Typical fillers are calcium carbonate, calcium sulfate, clays and powered metals. Some compounders add fillers to the resin mixture; others, after the catalyst has been added, or just prior to use.

Polyesters polymerize without splitting off water or

Photo courtesy: Hooker Chemical Corp.

After 6 minutes—standard polyester hull is completely ravaged.

Photo courtesy: Lunn Laminates, Inc.

Contact molding roof section for the Moscow pavilion.

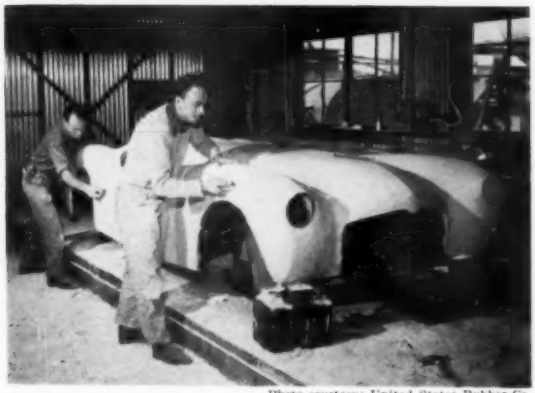


Photo courtesy: United States Rubber Co.

Preparing the plaster mock-up.

Photo courtesy: United States Rubber Co.

Preparing the polyester-glass female mold.

other volatile substances. Therefore, they can be molded or laminated at low pressures into homogenous structures. When these resins are used in compression and transfer molding operations, the mold does not have to be opened for out-gassing.

Many of the more spectacular reinforced-plastic applications, such as the American pavilion in Moscow, and the Chevrolet Corvette bodies, are examples of contact molding. This process lends itself to the preparation of master molds, small-run items, and prototypes, and is also the ideal method for the preparation of extremely large, complex assemblies. Contact molding involves the use of one mold only, either male or female. Molds have been prepared from wood, plaster, metal, epoxy, and polyester-glass. If the mold is prepared from a porous material, it must be properly sealed and polished since any imperfection will be permanently imprinted on the surface of the finished article. Before the mold can be used, it must be coated with a mold-release agent. To achieve a smooth surface on the molded part, a gel coat is applied. After the gel coat has hardened sufficiently so that the fibers will not penetrate or absorb it, the glass mat or cloth is laid-up in the mold. The gel coat can be prepared with pigments and/or fillers. These impart an opaque, colored covering to the finished product.

After lay-up, resin is added by brush or spray. The contact method uses approximately three times as much resin by weight as glass, however a portion of the resin can be replaced by filler. Impregnation of the mat must be thorough, and is accomplished by rolling with a suitable tool. This operation forces out air bubbles and enables the resin to displace the entrapped air in the mat. As many layers as necessary to acquire the desired thickness can be laminated in this way, but each individual layer must be rolled. The last layer usually can be positioned without the addition of extra resin since the rolling operation will force sufficient resin out of the laminate to cover it. An alternate to cold-setting is the autoclave method where higher temperatures and pressures are possible. Still other variations use a heated-type mold. While contact is the most universally used method, other techniques employ the new spray gun assemblies. These guns simultaneously deposit resin and chopped glass or flock in controlled proportions. Variations appear in different shops for each of the methods. Some shops use the flexible bag method, often in combination with the contact method or the vacuum preform method. Using a flexible bag in conjunction with contact laminating is a good way to prepare one-piece boat hulls and other large and asymmetrical arrangements. Other variations such as the vacuum method, matched die method, pre-impregnated molding, and vacuum preform method, will be discussed here at a later date.

—THE END

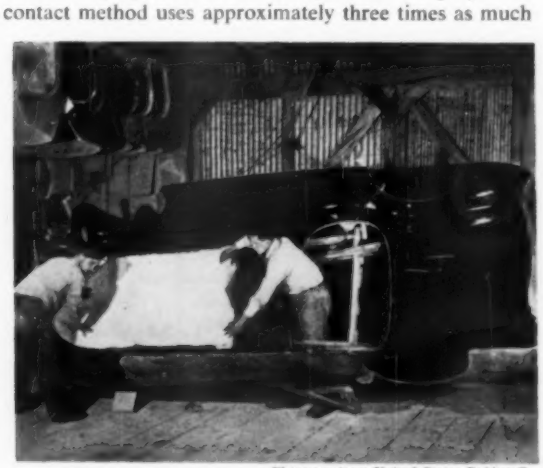


Photo courtesy: United States Rubber Co.

Laying up glass bat in prepared female mold.

Photo courtesy: United States Rubber Co.

Final finishing of polyester-glass auto body.

HERCULES

Plastics Hi-Lites

Vol. II, No. 1

New plastics are the big story in today's modern appliances

INSIDE OR OUT, PRO-FAX® APPLIES—a real performer, Pro-fax! It's built to stand up to the most rugged use challenges whether they be indoors or outside. As a result, this newest of plastics—Hercules polypropylene—has been finding increasing use in appliances that call for the finest in appearance and performance. Tough, rigid, heat-resistant, hard to stain, Pro-fax is richly colorful and the lightest plastic ever.

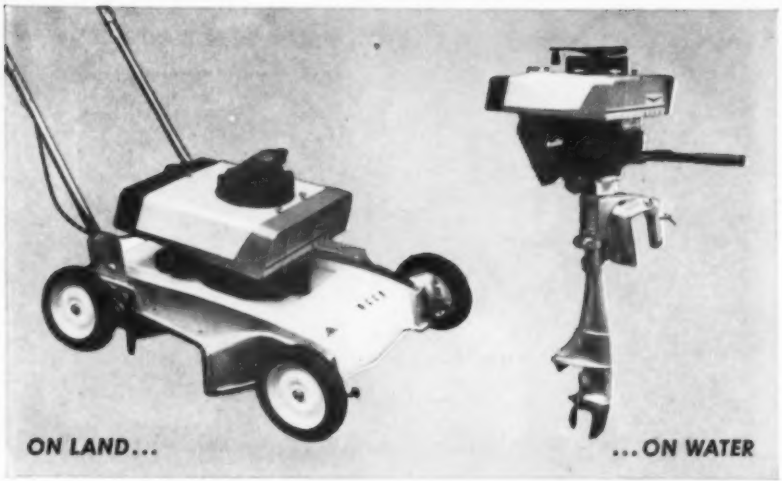
Pro-fax has opened up a whole area of new thermoplastic usage. Now designers have at their command a structural material that can often be used to replace more costly raw materials. Easy to mold, Pro-fax can be used to produce precision-formed units at low cost. It's little wonder that so many of the nation's leading appliance manufacturers are turning to Pro-fax to help solve production problems, and to give added values to their products.

A TRIPLE PLAY BY PRO-FAX

This Triple Duty Filter Dispenser, an exclusive feature found in all Philco-Bendix "Automagic" washers, is another example of the advanced engineering made possible by the proper use of such new plastics as Pro-fax polypropylene. Exploded view (left) shows the six injection-molded parts which make up the assembly of this compact, highly functional unit. Removable cap and cup shown at top are polyethylene. The remainder of the unit consists of four precision-molded Pro-fax parts which are ingeniously joined to form the body of the dispenser filter. The dispenser lid is permanently joined to the upper half of the body by spin-welding, while the lower half is attached by self-tapping screws. The removable filter trap (at bottom) has a molded bayonet-type catch, with an insert-molded metal mesh filter. Pro-fax was selected for this demanding assignment because of its outstanding resistance to detergents and chemicals, and its ability to withstand prolonged exposures to high temperatures. Lightweight; a handsome, colorful finish; and resistance to breakage are other features of the new unit. And of course the producer enjoyed all the important processing bonuses provided by Pro-fax, including more parts per pound, and dimensionally stable, precision fitting components.

Instantly accessible when the washer is open, Philco's Triple Duty Dispenser serves three important functions in the washing cycle. The entire tub of water is filtered six times a minute to remove all traces of lint. It provides automatic detergent dispensing at any preselected water level, insuring even dispersion; and it automatically dispenses clothes conditioner at the proper time to assure a softer, cleaner wash.

Molded by Seneca Plastics Company, Cambridge, Ohio.



DOUBLE PLAY BY ACCO

The new Acco "Outboard Mower" is not only an industry first, but one of the first big new merchandising ideas of many a year. It's a power mower with a motor that can be removed and attached to a propeller unit to make a powerful outboard motor. The conversion can be effected in minutes, and on land or water the motor is protected at all times by a colorful, durable housing molded with Pro-fax. Pro-fax proved the only plastic with all the requirements demanded by this new concept in dual-purpose equipment: lightweight, rigidity, resistance to heat, chemicals and staining, plus a lustrous surface finish that bespeaks quality merchandise.

Molded by Research Plastics, Inc., Jersey Shore, Penna.

A HIT BY REGINA

This attractive, low-cost plastic accessory is certain to be a hit with homemakers who own a Regina Polisher-Scrubber. Waxing is no longer a chore with this new automatic dispenser unit. Fingertip control assures uniform distribution of wax, avoiding waste and yielding professional results without splashing or stooping. For the ultimate in appearance and performance in this new appliance accessory, Regina selected Pro-fax. In addition to providing lightweight strength in a handsomely styled unit with a colorful, stain-proof finish, Pro-fax supplies the excellent sealing qualities needed for a leak-proof seal, plus resistance to wax solvents such as turpentine.

The new Pro-fax pump unit is easily attached to the Regina Polisher-Scrubber handle. When not in use, it will not hamper normal operation.

Pump unit molded by Ideal Plastics Division, Ideal Toy Corporation, Long Island, New York.

Design Hi-lites

The dramatic change-over by producers of light-duty liquid detergents to blow-molded plastic bottles has focused new attention on a long-established processing technique. Blow-molding is one of the oldest of plastic arts, and designers have long been intrigued by the intricate shapes and unusual forms which can be achieved by this method. Until recently, however, materials adaptable to blow-molding lacked the structural and functional characteristics required to yield rigid structures suited to a wide range of uses. The advent of such new plastic materials as Hi-fax, high-density polyethylene, has changed this picture to the point where blow-molding has now become the fastest growing sector of our industry.

Permitting the use of undercuts, blow-molding can achieve intricate shapes impossible by other methods. Modern version of classic vase in design below could serve as watering can, condiment bottle, or medicinal container. Sketches by Sundberg-Ferar.

Blow-molded Hi-fax containers can be designed with a "bellows" action in packages that serve as pumps or dispensers. Design shown above is for a household deodorant or insect spray container.

The sketches shown here are but two of the many exciting and different product ideas shown in a new Hercules film-strip, "Something New in Packaging." If you'd like to see this up-to-date report on a new industry and the materials which serve it, write or call us. It will take only minutes of your time, may put your new products years ahead.

CP60-3

HERCULES POWDER COMPANY
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900 Market Street, Wilmington 99, Delaware

THREE NEW MATERIALS FOR THE PLASTIC INDUSTRY

HI-FAX® HIGH-DENSITY POLYETHYLENE • PRO-FAX® POLYPROPYLENE • PENTON® CHLORINATED POLYETHER

HERCULES

ENGINEERING FORUM

Edited by:
R. H. HOEHN, *Chief Engineer*
Mack Molding Co., Inc.
Wayne, N. J.

Injection Molding The Refinement of Hot Runner Molding

PERHAPS the most significant development of recent years in injection molding technology has been the refinement of hot runner molding. The term, "Hot Runner Molding." has meant many things to many people in the past. Not too many years ago, what is now commonly referred to as a three-plate mold was occasionally considered to be a hot runner mold by some. Today, we are all vastly more sophisticated in these matters, what with the excellent dissemination of such information through the various activities of the Societies, technical articles, and by the publication of various research data by many of the raw material and machinery suppliers.

Since hot runner information made available to date has been scattered and sporadic, it seems that collecting and evaluating the various approaches to this method of molding would be a worthwhile project for this Forum to undertake. It is hoped that a resume will help the reader understand the over-all possibilities inherent in some of the various techniques now employed which have come to our attention.

In creating hot runner mold designs, we are usually attempting to accomplish one or more objectives. Since these are all so closely related, we frequently find ourselves improving our entire molding operation, rather than merely improving one phase of it.

Some of the more obvious benefits are as follows:

(1). Attain a maximum efficiency in the utilization of the molding machines' heating chambers (plasticating ability is the limiting dimension of most molding machines) through the elimination of the runner system in its entirety, thereby making available for molded parts those portions of both the shot and plasticating capacities of the machines which might ordinarily be "wasted" to produce runners. Obviously, we can substitute additional cavities to take advantage of the additional capacity we have thus made available for a given job in a given machine.

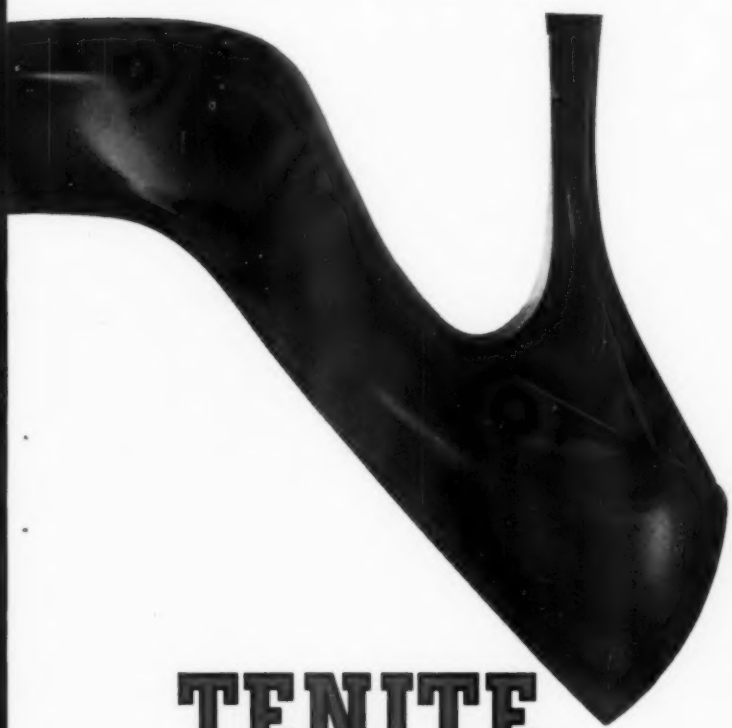
(2). Eliminate runners, as such, more readily to attain a fully automated and optimum-timed molding cycle. Frequently, machine cycle time is prolonged well beyond the time required to set the molded parts while waiting for the runner system to harden sufficiently to permit its removal. This situation is encountered even more frequently in fully-automatic molding operations in an effort to minimize the troubles sometimes encountered with clearing runners, which have a marked affinity for leader pins, stripper bolts, ejector pins, and the like, to which they cling with octopus-like tenacity. While runner removal is a problem in even the most carefully designed automatic mold, their complete elimination carries the added bonus of doing away with the need for sprue regrinding operations. It is true that some fully-automatic operations have a scrap grinder integrated into the machine cycle with runners delivered directly from the drop chute to the grinder by a conveyor system. The regrind then is proportionately blended with virgin material and fed back to the machine hopper, again automatically. Anything short of such a set-up will require some additional labor to handle regrinding, to say nothing of the possibilities for contamination and shrinkage.

(3). Create additional mold space. When the hot runner technique is applied to the type of job that would ordinarily be run in a three-plate, top-gated mold base, a considerable advantage is gained in reducing the press stroke and daylight-opening requirements by the elimination of the mold opening normally needed to remove the conventional runner. The several inches thus gained will permit the molding of deeper-draw objects and, again, result in the more efficient and complete utilization of a given machine's capabilities.

(4). Obtain a greater effective injection pressure in the mold cavity. On very large moldings, it usually is necessary to employ multiple gating techniques. It is not unusual to see runner systems radiating from the nozzle for a distance of several feet! Hot runner designs can avoid the rather severe pressure drops which can occur in such a system, particularly when these runners are kept to a minimum cross-section in the interests of rapid cycling. In such cases, the inclusion of the heated runner can well be the difference between

(Continued on page 69)

Heels molded of Tenite plastics have a natural "patent leather look"



Tenite Acetate and Tenite Butyrate were the first plastics used in volume to replace wood for heels.

The strength of these plastics far exceeds that of wood and markedly reduces breakage of heels during manufacturing, wearing or cobbling. Extremely versatile in finishing operations, they can be used "as molded," sprayed with lacquer, metallized, or covered with plastic, leather or fabric.

Today, many shoe manufacturers are taking advantage of the natural high gloss of these plastics and are standardizing on black Acetate heels or black Butyrate heels for patent leather footwear.

Requiring no spraying or covering, black* heels made of these Tenite plastics are perfect mates for patent leather shoes. With no surface coating or covering to peel off, they can withstand unusually hard wear without showing scuff marks. EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

TENITE

ACETATE • BUTYRATE

Eastman plastics for shoe heels

***While black usually is synonymous with patent leather, these Tenite plastics also are available in any other desired color, including clear-transparent.*

Shoes by **Ornsteen Shoe Company,** Haverhill, Mass. Heels finished by **Wm. Ornsteen Heel Co., Inc.,** Haverhill, Mass. Heels molded by **Ace Plastics Corp.,** Bradford, Mass.

NEWS of the Industry

new plants, labs & additions

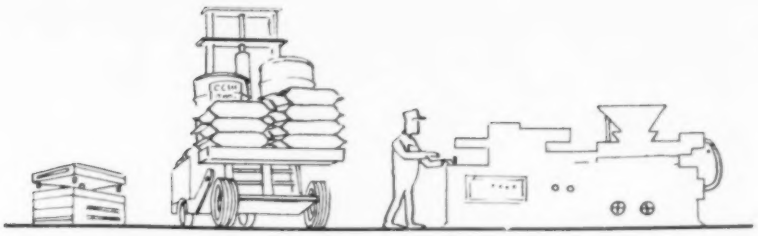
Following are the companies that have recently completed or are currently building new facilities, their locations, products involved and, when available, capacities: **Modern Plastics Machinery Corp.**—an 80,000 square foot plant in Clifton, N. J., which triples its capacity for producing extruders and processing machinery, while centralizing all other operations; **Philip Shuman & Sons**—larger quarters in Buffalo, N. Y., increasing capacity for grinding and processing both virgin and scrap material; **Hastings Plastics**—added warehouse space for its glass fabric products; **Deecy Products Co.**—a plant for handling molten phthalic anhydride to a capacity of a million pounds per month; **Dawbarn Brothers**—a 50,000 square foot addition to its olefin yarns plant; **Plicoflex, Inc.**—a 40,000 square foot plant in Houston, Tex., for producing pipeline wrapping tape of PVC laminated to butyl rubber; **Dow Chemical Co.**—a 36,000,000 pound phenol plant in the Northwest; **Plastic Materials & Polymers, Inc.**—a second plant in Slatersville, R. I., which should enable the firm to increase its sales of custom colored plastic materials by 33%; **Canada's National Research Council**—the first polyurethane (Hooker's Hetrofoam) radome in Ottawa; **Borden Chemical Co.**—a pilot plant for producing 1,000-pound lots of polyvinyl alcohol, polyvinyl acetate, acrylics, and styrene copolymers; **Reynolds Chemical Products Co.**—a 56,000 square foot wing to its urethane foam plant at Whitmore Lake, Mich.; **Poly-Cell Plastics Co.**—a color laboratory at Smithtown, N. Y.; **Northwest Plastics, Inc.**—a subsidiary plastics molding plant at Belle Plaine, Minn.; **Reichhold Chemicals, Inc.**—a 60-million pound phthalic anhydride plant at Newark, O., and a $2½-million addition to its phenol plant in Tuscaloosa, Ala.; **Goodrich-Gulf Chemicals, Inc.**—a plant in Port Neches, Tex., for the production of oriented polyolefins to have a capacity of 13-million pounds annually; **American Chemical Corp.**—offices and plant for the production of chlorinated hydrocarbons and polyvinyl resins in Long Beach, Calif.; **Furane Plastics, Inc.**—a 6,000 square foot epoxy plant in Hempstead, N. Y.; **Emery Industries**—a $6-million ozone oxidation plant for the production of azelaic and pelargonic acids at Cincinnati, O.; **Borden Chemical Co.**—an acrylic emulsions plant at Demopolis, Ala.; **Waldron-Hartig division of Midland-Ross Corp.**—an extrusion laboratory at Mountainside, N. J.; **Spencer Chemical Co.**—new offices at 575 Lexington Ave., New York City; **REF Mfg. Corp.**—a 20,000 square foot addition to its aircraft subassembly and electronic housings plant; **Kaye-Tex Mfg. Corp.**—a plant expansion at Yardville, N. J.; **Kordite Corp.**—a $2-million research and technical service center at Macedon, N. Y.; **Eastman Kodak Co.**—a 20-million pound polypropylene plant at Longview, Tex., to be operated by Texas Eastman Co.; **Molded Fiber Glass Body Co.**—a $250,000 plant in Ashtabula, O., for the production of 20,000 pounds of finished polyester resin daily; **Plastic Molders Supply**—a plant and office in Fort Worth, Tex., for the manufacture of gel coats and color paste dispersions; **Reginald B. Stoops,** engineering and marketing consultant in reinforced plastics—to 52 Hoyt St., Stamford, Conn., with facilities for development and research; **Perforating Industries, Inc.**—a 10,600 square foot plant in Linden, N. J.; **Minnesota Mining & Mfg. Co.**—a $10-million, 14-story administration building at its research center site; **J. O. Ross Engineering**—a new office at Mt. Prospect, Ill.; **Owens-Illinois Glass Co.**—a new plant in North Kansas City, Mo., and added facilities in St. Charles, Ill.; **Continental-Diamond Fibre Corp.**—a research center occupying 18,000 square feet in the Newark plant; **Finish Engineering Co.**—a 26,000 square foot plant in Erie, Pa., for the manufacture of plastics decorating equipment; **Cortland Industries, Inc.**—a remodeled plant in Chicago for installation of all vacuum forming facilities; **Monsanto Chemical Co.**—a multimillion dollar plant in the six-nation European Common Market for the manufacture of Saflex polyvinyl butyral sheet; and **Ethyl Corp.**—a plant in Orangeburg, S. C., for making aluminum alkyls and alkyl aluminum halides.

changes in ownership, new companies

Celanese Corp. of America has acquired Royal Mfg. Co., Inc., a leading manufacturer of plastic bottles and containers. Royal's plants in Prescott, Ariz., and Chicago, will be expanded, and a new plant will be built on the East Coast. Royal will operate as a Celanese division under its present management.

Chippewa Plastics Co., a division of Rexall Drug & Chemical Co., has purchased the facilities of Package Containers, Inc., Salinas, Calif. The West Coast plant will become Chippewa's flexible packaging division.

Decorative Engineering & Supply, Inc., Gardena, Calif., has purchased Precision Spray Mask Co. The firm is the only one on the West Coast making electroformed spray masks and fixtures. DE&S is closely affiliated with Bee Chemical Co., Chicago, having as chairman of the board, M. A. Self, president of Bee.



Radcor, Inc., is the name of a new infrared oven company which will be located at Bradner, O. In its inception stage, the firm was to have been called Barber Infrared Associates.

Richardson Co. has acquired a majority interest in Plastics Corp. of America, Stamford, Conn. Richardson is a manufacturer of industrial plastic and rubber products, and the new subsidiary is a relatively new producer of polystyrene.

Resisto Chemical, Inc., Wilmington, Del., has acquired Dri-Dux, Inc., and will market its line of plastic coatings. The subsidiary will be known as the Dri-Dux division.

Salem Plastics, Inc., a new firm, will produce transparent acrylic products for the aircraft and marine industries, plus fabricated insulation products. Plant location is Salem, O.

Stauffer Chemical Co. has acquired General Foam Products, Los Angeles manufacturer of Crest-Foam, an expanded polystyrene. The firm will be operated as a unit of Stauffer's molded products division. Another Stauffer acquisition is the plastic pipe & tube division of Anestite Co., Santa Barbara, Calif. This division has been moved to Vernon, Calif., and is operating as a unit of the molded products division also.

Ultrasonic Industries, Inc., is the name of a new Albertson, N. Y., firm established by Paul M. Platzman for the manufacture of ultrasonic cleaners. The firm's first product will be the diSONtegrator System Forty Ultrasonic Cleaner.

U. S. Industrial Chemicals Co.-International has been formed to provide sales assistance to European representatives handling USI's Petrothene polyethylene resin. Temporary headquarters have been established at Kirchenstrasse 13, Zug 1, Switzerland.

Wyatt's Plastics, Inc., has purchased Houston Rubber Co., and is now capable of molding all thermosetting materials, plus a complete line of elastomers.

business developments

The Society of the Plastics Industry has released figures showing sales of plastics raw materials up 25% in 1959 for a total of 5,600,000,000 pounds. Last year's value of plastic products was approximately $3-billion as opposed to $2½-billion in 1958. SPI's reinforced plastics division also has formed a prepreg committee which will be concerned primarily with standardization of test methods and nomenclature. Among the proposed test methods are tack, drape, gel-time, and resin and volatile content.

Spray-Bilt, Inc., Hialeah, Fla., has announced the availability of a consulting engineering service to all direct factory representatives and spray-builders. The firm supplies a gun which shoots chopped glass, resin, and catalyst—all of which meet outside the gun thereby eliminating clogging.

Metasap Chemical Co., a subsidiary of Nopco Chemical, becomes a Nopco division and will be known as the Metasap division. No change in personnel or address is contemplated.

Injection Molding

(Cont'd. from page 66)

being able to fill a shot successfully and complete frustration.

It would seem that we have prepared a rather powerful case in favor of the hot runner technique, but you say that "there must be some problems involved!" And so there are. Achieving the delicate balance required to keep the resin in the runner and gate systems at a high enough temperature to permit easy filling of subsequent shots, while perhaps violently cooling cavity areas immediately adjacent, is the fundamental problem to be overcome if satisfactory hot-runner operation is to be achieved.

Space does not permit continuing the subject now, but we plan to outline some of the approaches to this problem which we know to have been tried in our next column, and hope to receive data or case history accounts from those of our readers who have had any unusual experiences in this field. May we hear from you?

— The End

Names in the News

Dr. Charles J. Chaban

Dr. Charles J. Chaban has been elected vice president for research of Landers Corp. He has been with Landers since 1943, serving successively as research chemist, laboratory manager, and director of research and development.

Arthur C. Cope, head of the department of chemistry at Massachusetts Institute of Technology, has been chosen president-elect of the American Chemical Society. He will head the society in 1961. President for 1960 is **Dr. Albert L. Elder,** director of research of Corn Products Co., who succeeded **Dr. John C. Bailar, Jr.,** professor of inorganic chemistry at the University of Illinois on January 1. Dr. Cope is currently chairman of the ACS Board of Directors, of which he has been a member since 1951.

Elected to three-year terms on the Board of Directors were **Dr. Robert C. Elderfield,** professor of chemistry at the University of Michigan, and **Dr. Paul J. Flory**, executive director of research of Mellon Institute, Pittsburgh, Pa. **Dr. Charles L. Thomas,** scientific advisor of Sun Oil Co. was chosen an ACS Director-at-Large.

Augustus B. Kinzel, vice president for research of Union Carbide Corp., has been appointed chairman of The National Academy of Sciences-National Research Council's division of engineering and industrial research. He succeeds the late **Vice Admiral Edward Lull Cochrane,** USN (Ret.). As chairman, Dr. Kinzel,who has been with Union Carbide since 1926, will guide the division's activities in stimulating and furthering technological research in such diverse fields as traffic engineering, building construction, material development, and electrical insulation.

Henry F. Weinkam has been named manager of REF Manufacturing Corp.'s Plant I., where he will supervise personnel, quality control, and manufacturing techniques. He had been president and general manager of Winx Products, Inc.

George N. Keyser has been appointed product sales manager of industrial products by Chippewa Plastics Co. As sales manager with Arkell Safety Bag Co., he was concerned with packaging developments, and will now develop new applications for Chippewa's heavy-duty polyethylene bag.

Robert D. Forger has been appointed administrative assistant on the national office staff of the Society of Plastics Engineers, Inc. Formerly an engineer and manager of technical publicity at Dorr-Oliver, Inc., he will be responsible for the society's public relations program.

Randolph H. Barnard has resigned as president of Johns-Manville Fiber Glass Inc., but will continue with the company as a consultant on fiber glass. **Francis H. May, Jr.,** vice president, has assumed full responsibility for administration. Both men were executives with Glass Fibers, Inc., which merged with L.O.F. Glass Fibers Co. in 1955. The latter was acquired by Johns-Manville in 1958.

Joseph C. Ryan

Joseph C. Ryan, manager for the southwest district of Lenox, Inc., has been appointed western sales manager by Lenox Plastics, Inc. From his office in Los Angeles, Mr. Ryan will cover 11 states composing the new western sales division.

Robert A. Johnston has been named a project leader, materials application section, for Evans Research & Development Corp.

J. George Grimm has been elected vice president in charge of sales at Stewart Bolling & Co., Inc. Mr. Grimm, who has been with Bolling for 15 years, moves up from general sales manager.

Morrison M. Bump

Morrison M. Bump has been elected executive vice president of United Carbon Co., Inc. Mr. Bump will continue as director of marketing for the parent firm, United Carbon Co. Before joining United Carbon, he had been president of Union Paste Co.

James A. Gregg has been appointed sales engineering representative for Swedlow, Inc. From headquarters in Arlington, Tex., he will cover New Mexico, Colorado, Oklahoma, Kansas, and Texas.

Harold L. Kast has been named product engineer, thermosetting products, at Tech-Art Plastics Co. He previously served as plant manager for Valley Molding Co.

OBITUARY

Otto Haas, founder and honorary chairman of the board of Rohm & Haas Co., died on January 2, only a few days after his retirement as president of the firm. Born in Stuttgart, Germany, Mr. Haas came to the United States in 1902 and began to work for an export firm dealing in hides.

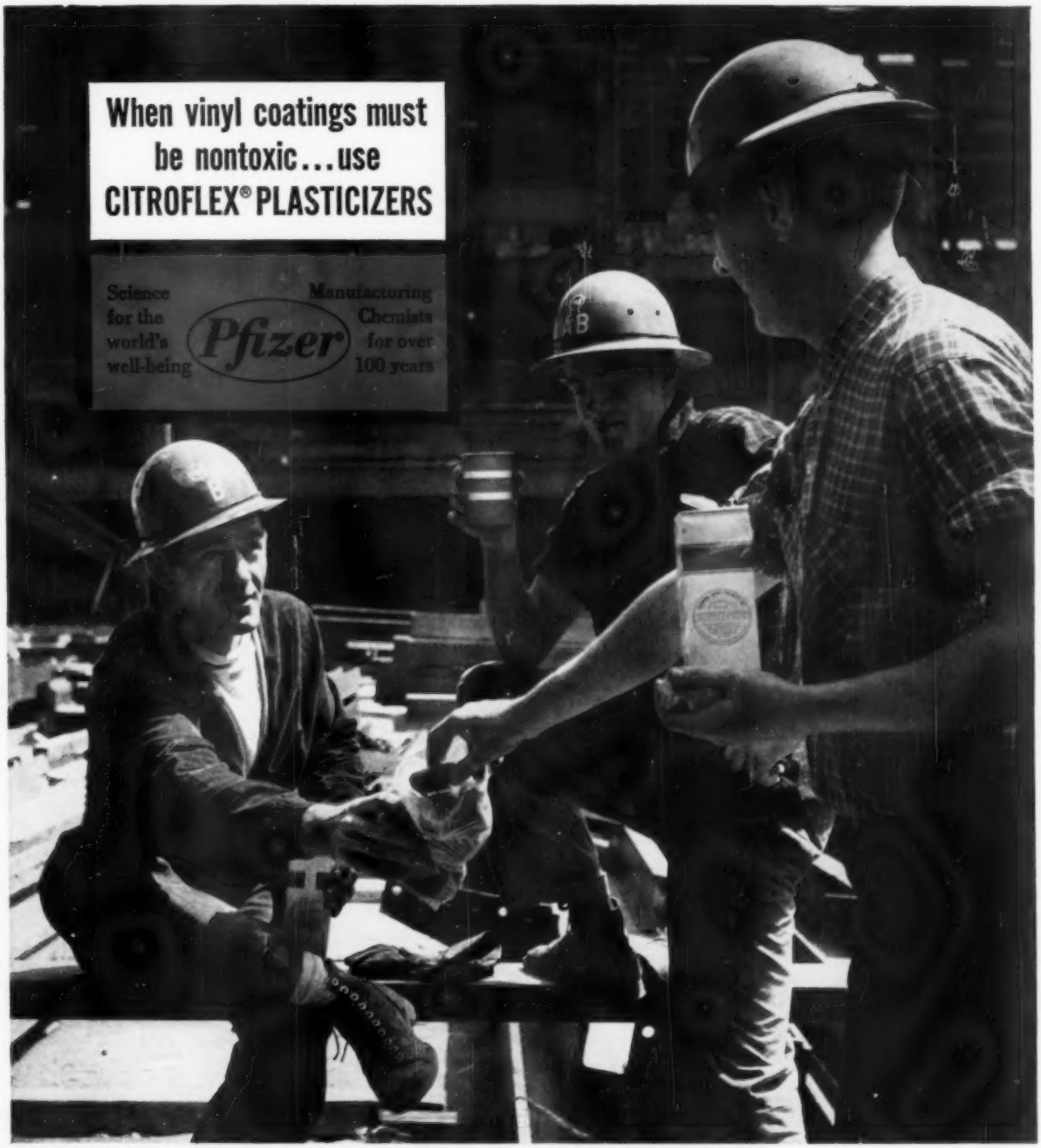
The Rohm & Haas association was established in Germany in 1907 to manufacture Oropon, a chemical used to prepare hides for tanning. Mr. Haas set up the American firm in 1909, while Dr. Otto Rohm headed the German division.

The firm's list of products has steadily increased. It has expanded not only to produce other chemicals for leather manufacture, but synthetic resins and chemicals for the plastics, agricultural, and textile industries as well.

Frank C. Rowley, Durez Plastics division of Hooker Chemical Corp., died on Thursday, January 7, in Buffalo, N. Y. Associated with Durez for 23 years, Mr. Rowley held the position of product manager, molding compounds, in the sales department at his death.

He began with Durez in 1936 as a sales engineer in the Chicago district. In 1950 he came to North Tonawanda as assistant sales manager, molding compounds, and was promoted to sales manager in 1955.

Mr. Rowley was a member of the Society of Plastics Engineers and the Society of the Plastics Industry.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CITROFLEX A-4 (Acetyl Tributyl Citrate) for polyvinyls—shows excellent results in plasticizing vinyl films for meat wrapping, vinyl coatings for food containers and hot drink cups, vinyl plastisols for bottle crown liners and food jar sealing rings.

CITROFLEX A-2 (Acetyl Triethyl Citrate) is especially suited for cellulosic packaging materials used for doughnuts, processed meats, etc.

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New Materials

Write item numbers on Reader's Service Card (p. 107) to obtain more information.

Organic Titanates

E. I. du Pont de Nemours & Co. is offering commercial quantities of six organic titanium compounds for use as intermediates in industrial adhesives, water repellents, and resins, and directly as adhesion promoters and pigment dispersants. Four ortho esters and two of the more stable chelates of titanium are available under the trademark Tyzor. They are: tetraisopropyl titanate, tetrabutyl titanate, tetrakis (2-ethyl-hexyl) titanate, tetraoctylene glycol titanate, triethanolamine titanate ester, and tetrastearyl titanate. The latter compound is a solid, while all of the others are liquids.

Distinguished by high chemical reactivity, the titanium esters may be used in producing inorganic coatings which are adherent to most surfaces and are especially valuable in forming adhesion-promoting films between dissimilar, hard-to-stick-together materials.

Polymers containing hydroxyl groups can be cross-linked with the titanates.

Typical properties are:

	Tetra-isopropyl titanate	Tetrakis Tetra-butyl titanate	(2-ethyl-hexyl) titanate
Molecular weight	284	340	564
Melting point, °C.	20	<—40	<—25
Density, 25° C.	0.955	0.994	0.926
Viscosity, 25° C. cps.	4.5	67	103

	Tetra-stearyl titanate	Triethanolamine titanate ester	Tetra-octylene glycol titanate
Molecular weight	1124	——	——
Melting point, °C.	68	——	——
Density, 25° C.	——	1.061	0.947
Viscosity, 25 °C., cps.	——	88	50

Readers' Service Item 1

Non-Metallic Gold Flake

An inexpensive additive for plastics which resembles gold has been made available by Zonolite Corp. Called Bright Gold Flake, it is derived from Vermiculite, a member of the mica family. Lightweight, fireproof, and inert, the material can be flocked or dusted onto any surface adhesive; mixed or ball-milled into most resin formulations.

Bright Gold Flake is marketed in meshes from minus 10 to plus 200; however, being friable, it must be handled with care in dispersions and under mechanical stress. It neither tarnishes nor bleeds. Greatest brilliance is obtained if fine forming is minimized during mixing.

Typical properties are reported as follows:

pH.	7
Surface	Mirror
Density	10-20
Melting point, °F.	2,000-2,400
Particle shape	Thin plates
Specific heat, 70°F., BTU/lb./°F.	0.2

Readers' Service Item 2

Low-Viscosity Potting System

RF-95545, Resin Formulators, Inc.'s resin system with low working viscosity, is designed for potting and encapsulating electronic equipment which is required to withstand high temperatures or chemical attack. Heat distortion after post-cure is 375° F. In laboratory tests, a properly cured system resisted continuous attack by trichlorethylene for two weeks. Peak exothermic heating of a 1,000-gram mass after eight hours at 77° F. is 150° F.

Other characteristics of the cured system are:

Dielectric constant, 10^4 cps., 75° F.	4.0
Dissipation factor, 10^4 cps., 75° F.	0.018
Dielectric strength, volts/mil.	500
Tensile strength, psi.	5,000-9,000
Compressive strength, psi.	20,750-24,750

Readers' Service Item 3

Medium-Impact ABS Polymer

Kralastic MM, a recent introduction of U. S. Rubber's Naugatuck Chemical division, is said to be more rigid and have less tendency to creep or flow under load than any other thermoplastic material. Rigidity is twice that of nylon, and resistance to creep is four times greater. Suggested applications include business machine housings, fan blades, data bloc assemblies, roller skate wheel, gears, and pulleys—to name a few. Parts can be obtained with a very high gloss.

Typical phyisical properties are reported as follows:

Specific gravity	1.07
Impact strength, ft.lbs./in. notch, ⅛-inch bar	1.3-1.9
Compressive strength, psi.	11,000
Compressive modulus, psi.	370,000
Flexural strength, psi.	13,500
Flexural modulus, psi	450,000
Tensile strength, psi.	8,800
Hardness, Rockwell R.	118
Thermal coefficient of expansion, in./in./°F.	0.000032
Thermal conductivity, BTU/hr./ft.² per °F/in.	1.8
Specific heat, BTU/lb./°F.	0.38
Deflection temperature, ¼-inch bar, annealed, °F.	200
Water absorption, % gained, 24 hrs.	0.3
Compression ratio	1.8-2
Compression molding temperature, °F.	325-400
Pressure, psi.	1,000+
Injection molding temperature, °F.	350-600
Pressure, psi.	6,000-30,000
Mold shrinkage, average, in./in.	0.004-0.005
Extrusion temperature, °F.	350-450
Dielectric strength, short time, friction	0.2
Dielectric strength, short time, ⅛ inch	386
Volume resistivity, ohm/cm.	2.7×10^{16}
Dielectric constant, 60 cps.	3.1
Dissipation factor, 60 cps.	0.004
Loss factor, 60 cps.	0.012

Readers' Service Item 4

Cyclobutanediol Derivatives

Eastman Chemical Products, Inc., has announced the development of an economically practical method of producing tetramethyl-1, 3-cyclobutanedione and its reduction product 2,2,4,4-tetramethyl-1, 2-cyclobutanediol. Both are white crystalline solids.

Esters and polyesters of cyclobutanediol are reported to have shown excellent thermal and hydrolytic stability in preliminary studies. This stability suggests the use of the di-2-ethylhexoate and other esters as plasticizers. Polyesters may be used for saturated and unsaturated compounds and as the basis for urethane derivatives.

Typical properties of 2,2,4,4-tetramethyl-1,3-cyclobutanediol are:

Molecular weight	144.2
Melting point, °C.	125-135
Boiling point, °C., approximate	210-215
Flash point, Cleveland Open Cup, °C.	125-135

Readers' Service Item 5

NEWEST FROM NUODEX

NUOSTABE V-134

the new standard of stabilizer performance for every vinyl application

From the Nuodex Laboratories comes another first . . . Nuostabe V-134, a superior liquid barium-cadmium complex with unparalleled stabilizing effectiveness. No other stabilizer can match its high performance and consistent control in every phase of vinyl processing . . . calendering . . . plastisols and organosols . . . extrusions . . . injection molding . . . solutions.

Vinyl compounds stabilized with Nuostabe V-134 exhibit excellent initial color and excellent resistance to heat and light degradation. True tones of sensitive organic pigments are maintained throughout processing cycles. Whatever your process, you have precise control, because the effectiveness of Nuostabe V-134 is consistent and uniform time after time. For, as with other Nuodex products, you are assured of CERTIFIED QUALITY.

You needn't take our word about the superiority of new Nuostabe V-134. Its performance has been thoroughly established. Your Nuodex representative can provide you with graphic evidence that you can see and compare. Call him now—or write to Nuodex for further information.

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High-Flash-Point Cement

Schwartz Chemical Co., Inc. has announced an acetate cement with a flash point over 100° F., intended to reduce mass production hazards in bonding cellulose acetate or butyrate sections. The low-volatility, water-white cement will not thicken when applied from open containers or felt pads, but its viscosity can be increased by adding cellulose acetate shavings.

Readers' Service Item 6

High-Temperature Laminate

TRC-X reinforced phenolic laminate for missiles and aircraft was developed by Riverside Plastics Corp. to meet the need for a low-dielectric, structurally-strong material in the 1,000° F. range. Reported to endure a 1,000° F. atmosphere without blistering or delaminating for several minutes, the laminate may be used in missile nose cones, wing and fin insulation for metallic missile cones, and radomes. It may also be used as a heat insulation barrier to prevent annealing when bonded, for example, to aluminum.

General properties of the laminate include:

Flexural strength, psi, 800° F	41,000
Modulus of elasticity, psi, 30 min. @ 800° F.	260,000
Tensile strength, psi, 30 sec. @ 800° F.	46,000
Modulus of elasticity, psi, 30 min. @ 800° F.	240,000
Compression strength, psi, 30 min. @ 500° F	35,000
Coefficient of thermal expansion, in./in./° F @ 500° F	3.2×10^{-6}
Thermal conductivity, BTU/hr./sq.ft./°F/in.	1.2
Specific heat @ 500° F	0.3

Readers' Service Item 7

Etchant for Bonding Teflon

Tetra-Etch, a sodium solution developed by W. L. Gore & Associates, Inc., can be used to bond Teflon to itself and to other materials. The solution reacts with polytetrafluoroethylene resin to form a carbonaceous film, which serves to anchor adhesives on the treated surface. The compound is compatible with epoxy, phenol formaldehyde, and most rubber and silicone adhesives.

The solution is applied to the Teflon by pouring or, in the case of wire, dipping. Treatment time ranges from about five seconds to one minute. Resulting peel strength with one epoxy adhesive ranges from 17 pounds per inch on smoother Teflon to 35 pounds per inch on corrugated ribbon.

Rates of 50 to 60 fpm. are possible on continuous-dip lines if wire, tape, or tubing is preheated to 180-200° F. before pulling it through the etchant. It may be used for field application as well as in-plant work.

Readers' Service Item 8

Alkyd-Based Glass Coating

Picture windows and other large expanses of glass may be treated with an alkyd-based liquid developed by E. I. du Pont de Nemours & Co. to minimize fading, glare, and heat. Applied with special flow coating equipment by Sun-X dealers of American Glass Tinting Corp., windows may be coated in position.

The liquid plastic, available in eight colors and frosted, dries in 30-40 minutes, after which it can be washed without scratching, peeling, or chipping. Tests of a gold-colored sample indicate the material will withstand temperatures of —40° F. for 18 hours and 160° F. for 24 hours, as well as relative humidity of 80-85%.

Readers' Service Item 9

CUSTOM DESIGNED MACHINERY . . . . by EEMCO

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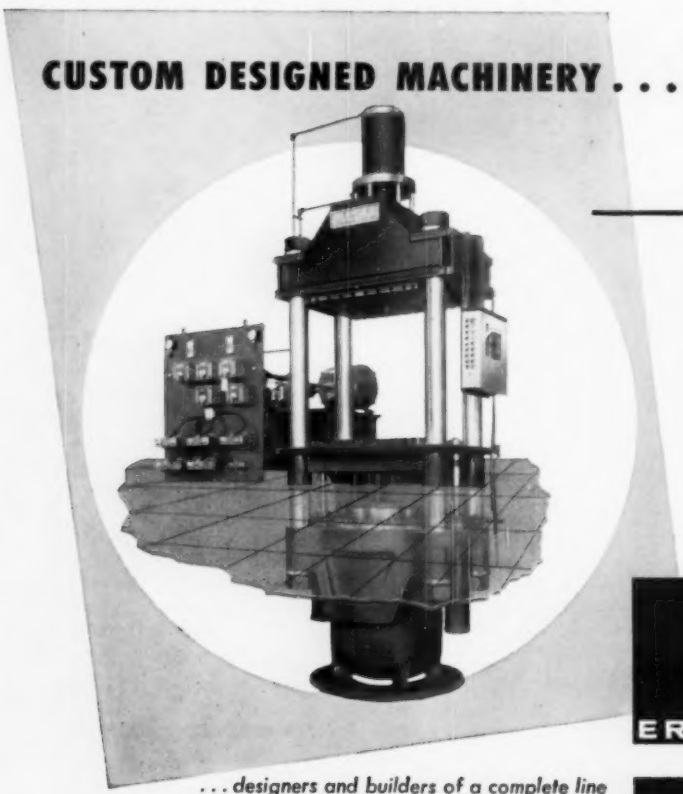

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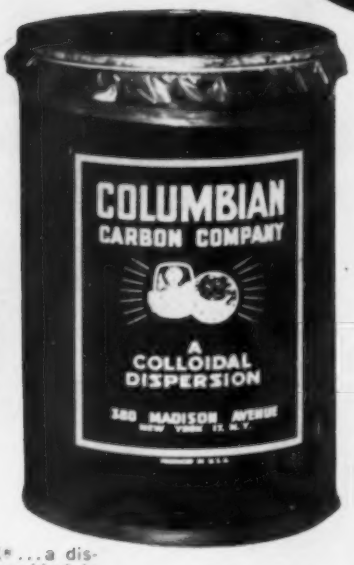


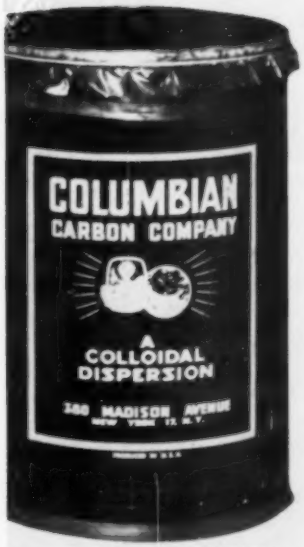
COVINYLBLAK®...a dispersion of carbon black in vinyl resin—chip form.

COSTYRENEBLAK®...high quality colloidal dispersions of carbon black in polystyrene resin—concentrated granular form.

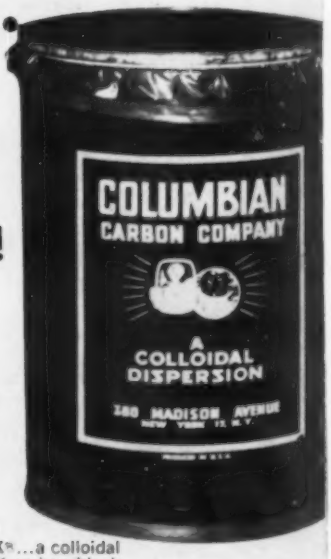
COLUMBIAN...

outstanding carbon black dispersions for plastics

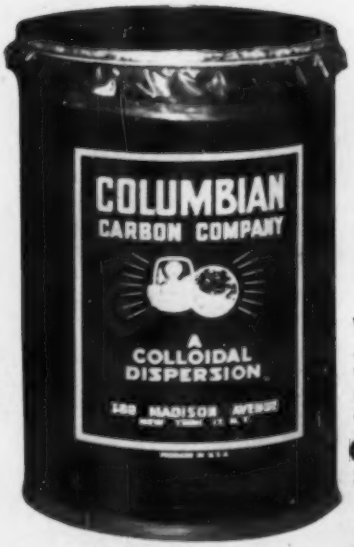
every step of the way!



COPEENBLAK®...a colloidal dispersion of carbon black in polyethylene resin—concentrated form.



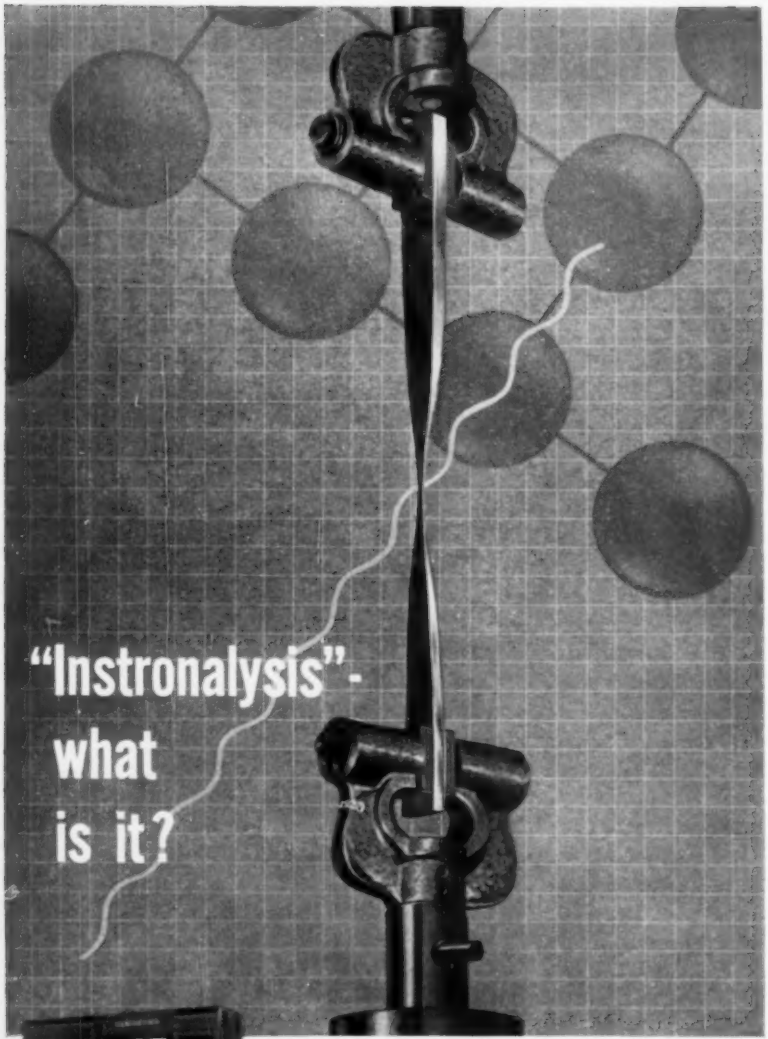
COWAXBLAK®...a colloidal dispersion of carbon black in chlorinated paraffin—chip form.



AQUABLAKS®...water dispersions of carbon black for integral dyeing of synthetic fibers.

Whatever your need in the plastics industry ...Columbian's predispersed carbon blacks will meet your most exacting requirements efficiently and economically...provide unsurpassed quality...and profit!

COLUMBIAN CARBON COMPANY
380 Madison Avenue, New York 17, N. Y.



The Instron comes in various models and sizes, to suit the widest applications — for tests under all sorts of environmental conditions. ILLUSTRATED: **FLOOR MODEL**—load ranges from 2 grams to 10,000 lbs.

Application reprints on many fields of testing are yours for the asking. In particular, the study of the time-temperature dependency of visco-elastic materials covered in Bulletins P.C.-2 and R-3.

"Instronalysis" means in-depth testing of materials with the Instron Universal Tester. You won't find the word in Webster's, but it is a term of importance to every laboratory concerned with modern testing techniques.

That's because today's technology demands nothing less than in-depth testing. Stress-strain curves alone are no longer adequate to measure the characteristics of long-chain molecular materials and other new "miracle" products. Today's tester must be able to determine the effect of different strain rates at various temperatures, energy loss under repeated cycling, stress relaxation and recovery, recoverable and unrecoverable creep, and many more characteristics beyond the scope of conventional equipment.

"Instronalysis" brings together both routine and advanced testing techniques within easy reach of a single instrument. It's what we mean when we say "You can do more with an Instron."

INSTRON
ENGINEERING CORPORATION
2501 Washington Street, Canton, Mass.

Urethane Foam Catalysts

Three catalysts for one-shot urethane foam production are commercially available from Metal and Thermit Corp. Designated T-8, T-12, and stannous octoate, the catalysts are, respectively, dibutyltin di-2 ethyl hexoate, dibutyltin dilaurate, and stannous 2-ethylhexoate, tin octoate. T-8 is a waxy, white solid insoluble in water and soluble in most organic solvents. T-12 is a high boiling, slightly yellow, oily liquid. Stannous octoate is a clear, very light yellow, somewhat viscous liquid soluble in most organic solvents.

Typical properties of the catalysts are:

	T-8	T-12	Stannous octoate
Formula weight	519.32	631.52	405.1
Specific gravity, 25°C.	1.070	1.05	1.26
Melting point ° C.	54-60	——	——
Acid number	210-219	170-180	——
Tin content %	21.8-23.2	18-19.5	27.5-29.5

Readers' Service Item 10

Epoxy Viscosity Modifier

Terpox, Heyden Newport Chemical Corp.'s viscosity modifier, has been made available in development quantities. As a reducing agent for epoxies, Terpox is intended to promote penetration and wetting ability, and increase filler loading for potting, casting, laminating, coating, adhesive formulations, body solders, and concrete patching compounds. Systems incorporating this difunctional oxy- derivative of a terpene can be formulated to low working viscosities while retaining good cured characteristics.

A light-colored, low viscosity liquid, Terpox is applicable to amine and anhydride cured epoxy systems. Density is 0.956 and refractive index, 1.478.

Readers' Service Item 11

ERRATUM

On page 62 of the January, 1960, issue, the name of Mearl Corp., producers of synthetic pearl pigments, was inadvertently misspelled.

COMPARE ... ADMEX 770 against other polymeric plasticizers—in these 4 significant tests!

RUBBER MIGRATION

	Admex 770	Polymeric X	Polymeric Y
Neoprene	0.6	2.67	1.06
GRS	0.23	2.01	1.22

VINYL-RUBBER CONTACT frequently solves many industry problems. Admex 770 shows the highest resistance to migration into rubber products used for electrical cables, floor mats, shoe liners and rubber-based adhesives.

SOAP EXTRACTION

	Admex 77	Polymeric X	Polymeric Y
200F (24 hrs.)	3.48	4.99	3.41
140F (24 hrs.)	1.64	3.65	3.03
Cycling 140F (3 hrs.)	1.27	2.79	2.11

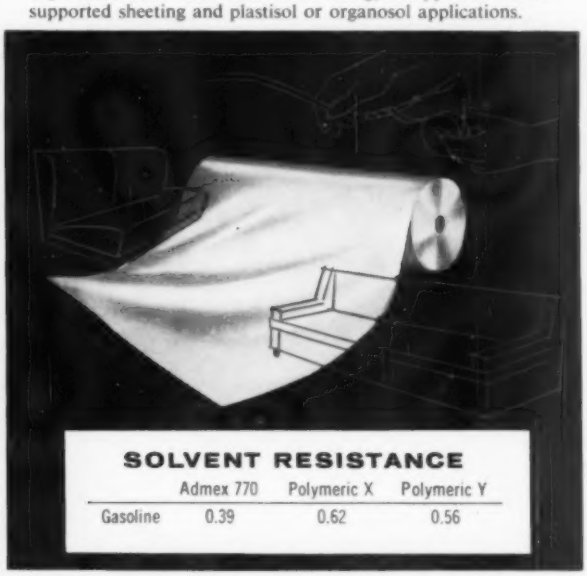
ADMEX 770 insures long-term flexibility in vinyl products subjected to soapy water contact, either by static or cycling exposure. Try Admex 770 in floor and wall covering, in supported and unsupported sheeting and plastisol or organosol applications.

STYRENE CRAZE

Comparative Retention of Tensile Strength — Admex 770 | Polymeric X | Polymeric Y

Stress cracking of molded polystyrene

REFRIGERATOR GASKETS compounded with Admex 770 show improved resistance to crazing and marring of polystyrene. Excellent blending and extrudability, plus low odor level, make this polymeric an ideal choice for high quality profiles.



SOLVENT RESISTANCE

	Admex 770	Polymeric X	Polymeric Y
Gasoline	0.39	0.62	0.56

DO YOUR upholstery, film and sheet specifications call for high solvent resistance? Admex 770 proves superior to many costlier polymerics in its resistance to extraction by fuel and cleaning type solvents.

For data and samples, write today:

Admex
Vinyl Plasticizers

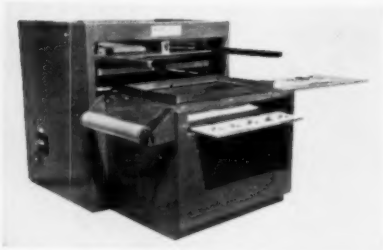
ADM PRODUCTS: Linseed, Soybean and Marine Oils, Synthetic and Natural Resins, Fatty Acids and Alcohols, Vinyl Plasticizers, Hydrogenated Glycerides, Sperm Oil, Foundry Binders, Bentonite, Industrial Cereal, Vegetable Proteins, Wheat Flour, Dehydrated Alfalfa, Livestock and Poultry Feeds.

Archer-Daniels-Midland

Archer QUALITY

New Equipment

Write item numbers on Readers' Service Card (p. 107) to obtain more information.



Skin-Pak's Model F.

Skin Packager

Skin-Pak Machinery Co., Inc., is offering the Model F automatic skin packaging machine which, when used with polyethylene-coated Mylar film, can be used with uncoated and unperforated board. Featuring dual operating switches for maximum operator safety, the packager will also handle vinyls, acetates, and butyrates at least one mil thick. Board requirements are 30 mils.

When using polyethylene-Mylar film, heating cycle time is 8-10 seconds, while vacuum cycle is 5-6 seconds. Film cut-off, heater travel, vacuum cycle, and film clamp are automatic. Production cycle is estimated at two master cards, 22 by 34 inches, per minute. For blister or bubble fabrication male and female molds can be introduced.

Other specifications of Model F include:

Bed size, inches	22 x 34
Film width, inches	25
Drape, inches	5
Vacuum pump and tank, cfm	9
Hp.	¾
Wattage, kw.	10
Voltage	220
Phases	3
Compressed air requirements, cfm	5
Psi.	60
Floor space, inches	84 x 60
Weight, lbs.	1100

Readers' Service Item 21

Portable High Shear Mixer

Specialty Machinery Corp. has added portable model PM 756 to its line of mixing equipment. Able to accommodate batches of 5-300 gallons, the unit occupies a 48-inch diameter tank with 5-inch clearance underneath. The blade is adjusted from 6-54 inches by a pedal-operated hydraulic system.

Specialty Model PM 756 mixer.

Model PM 756 will handle viscosities as high as 100,000 cps. It is furnished in variable and single speed models, explosion proof and non-explosion proof in 5, 7½ and 10 hp. Single speed models operate at 1,800 rpm; variable speeds from 800-3,600 rpm. An assortment of blades is supplied with each unit.

Readers' Service Item 22

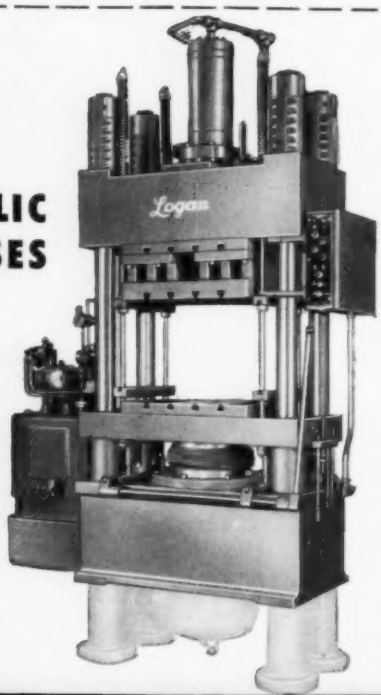
Logan

HYDRAULIC MOLDING PRESSES

Complete Line 10 To 300 Tons

TRANSFER OR COMPRESSION

- Semi-Automatic
- Self-Contained
- Fast Cycling
- Full Controls
- Accurate
- Economical



When you write for new catalog also request that a Logan Engineer call upon you for free production analysis.

LOGAN HYDRAULICS, INC.

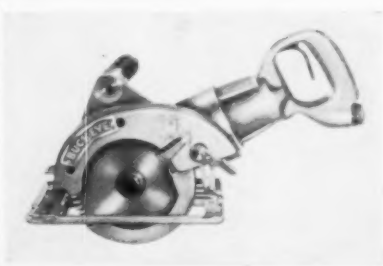
A SUBSIDIARY OF LOGAN ENGINEERING CO.

4901 WEST LAWRENCE AVENUE • CHICAGO 30, ILLINOIS

Portable Air-Powered Saw

Buckeye Tools Corp. has made available a ⅜-inch arbor pneumatic saw. Model 74Z-147A operates at 4,800 rpm. to cut wood, plastic, and some non-ferrous metals. Weighing 16½ pounds, the saw will cut as deep as 1½ inches. Blade diameter is 6½ inches and the angle of cut is controlled by a tilt table from 0-45°. Working air pressure of 90-100 psi. and hose of ½-inch I.D. are recommended for maximum efficiency.

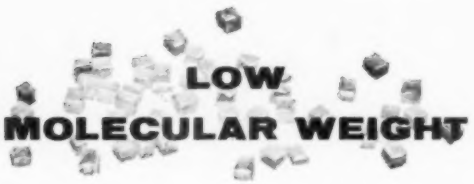
The saw is powered by a Buckeye X-4 governed and spiral bevel-geared air motor. Dead handle is reversible left or right for visibility. An adapter for blades with diamond-shaped arbor holes is available as optional equipment.



Buckeye's pneumatic saw.

Readers' Service Item 23

Polyethylene Means Greater Profit!



A-C® Polyethylene

FOR FASTER CYCLES

HOW do you get faster operations?

With A-C Polyethylene, faster operations are a *certainty*. Your equipment can be operated at lower pressures and at increased speeds. Melt index is always under perfect control. No release problems even with mirror-finish molds or other time-consuming difficulties with A-C Polyethylene! It all adds up to a faster, more profitable operation.

HOW can you cut down on grades in inventory?

Don't tie up your money! A few virgin resin grades do the work of a wide selection of melt indices. A switch to A-C Polyethylene gives you, at your command, a "tailor-made" resin to fit a particular end part. A simple change of low molecular weight percentages in the dry blending step will give you a wide control of characteristics. Let us demonstrate with a trial run.

---

for INJECTION MOLDING

Molders who use A-C Polyethylene in their operation gain distinct competitive advantages. Controlled gloss, better color dispersion, and the ability to run larger, more intricate parts and the filling of multi-cavity molds are the definite product advantages. Faster cycle, positive mold release, lower operating temperature and less overall machine maintenance, are the profit-making features contributed by the controlled flow possible with A-C Polyethylene.

for SLUSH MOLDING AND CENTRIFUGAL CASTING

A-C Polyethylene offers an entirely new material for slush molding. With this new polymer you can use less expensive molds; you get faithful mold reproduction with fine detail; and the finished part has a warm, "life-like" feel. Finishes from dull to high gloss are possible. Finished products can be decorated to any specifications.

for FILMS, PLAIN AND COLORED

In the extrusion of polyethylene film, adding A-C Polyethylene can give faster rates at lower extrusion temperatures and make gauge control easier.

For colored film, A-C Polyethylene is invaluable for even, streakless pigment dispersion. Colored films using A-C Polyethylene dispersed color pigments are strikingly brilliant and uniform.

for PLASTIC COATINGS

Coatings containing A-C Polyethylene give a hard, scuff-resistant, glossy surface. Excellent low temperature flexibility and the elimination of blocking problems are added attractions to the converter.

Bread and frozen food wraps are glossy and scuff-resistant.

Shipping cartons are grease resistant and need no liner to protect contents from fibre scratchings.

Butter and frozen food cartons, and bakery cartons are grease resistant and feed as single units to automatic packaging machinery.

SEMET-SOLVAY PETROCHEMICAL DIVISION
Dept. MPE-500, 40 Rector Street
New York 6, N. Y.

National Distribution • Warehousing in Principal Cities

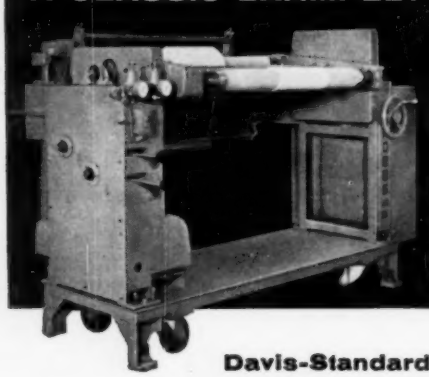
Allied Chemical

HOBBS 44"
"Versawind"

with Model 25T
Davis-Standard
Thermatic* Extruder
in film winding operation

More For Your Winding Money!

44" Hobbs "Versawind" at Davis-Standard A CLASSIC EXAMPLE!



Hobbs *does* give you more for your winding money and here is proof positive!

The 44" Hobbs Versawind shown here is joined to a Thermatic Extruder, Die and Blown Film Tower manufactured by Davis-Standard, a division of Franklin Research Corporation of Mystic, Connecticut. Operating on a 5-day a week basis, the unit tests batches of thermoplastics sent in by extruder customers and runs pilot extruder tests.

Davis-Standard reports

"We selected this Hobbs winder because, in addition to the greater output that it permits, we get more control and range, which are essential for our testing purposes. Every batch of material we run requires a slightly different set-up and the Hobbs Versawind adapts quickly to whatever the tolerance requirement may be."

In fact, Davis-Standard is so confident that Hobbs is the best film winding machine for the money that it offers its famous "Thermatic" Extruder, Die and Blown Film Tower and the Hobbs Versawind as a packaged assembly.

Hobbs builds winding drives and stands from the ground up to best fit your requirements. Hobbs manufactures all types of web winding equipment with all types of winding drives, stands and tension controls (electrical, mechanical, hydraulic, etc.). *Patented

EST. 1882 HOBBS MANUFACTURING COMPANY

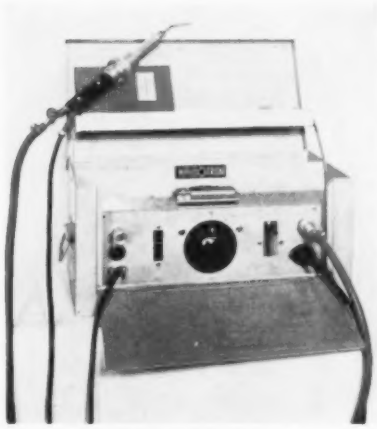
Ask for "Principles and Practices of MODERN WINDING." A copy is yours on request. Get More Winding For Your Money!

78B Salisbury Street, Worcester 5, Massachusetts

Representatives in Irvington, N. J., Chicago, Cleveland, Greenville, S. C., Louisville, Los Angeles, Toronto and other Principal Cities

475-9

WINDERS • WINDING STANDS • HAND & POWER SHEARS
SLITTERS • AUTOMATIC CUTTERS • DIE PRESSES



Weldotron Model 3-TE.

Plastic Welding Kit

Weldotron Model 3-TE plastic welding kit supplies all controls and meters for hot air welding in a unit. Controls are permanently mounted in the cabinet, produced by Plastic Welding Corp., while the input and output air fittings can be disconnected. The 18-inch torch is merely plugged into the air outlet.

Controls in the cabinet include line breaker switch, powerstat voltage control, flow meter, flow control valve, and thermometer. Cord and air hose are 10 feet long. Maximum temperature created by the 115-volt A.C., 400 watt heater is 700° F.

Readers' Service Item 24

Vacuum Oven

Grieve-Hendry Co., Inc., is producing a vacuum oven with recirculating blower for increased speed in work load heating before or during vacuum pumping. Vacuum to 29.5 inches Hg is provided by a rotary vane type, water cooled pump with forced feed lubrication.

Inconel sheathed heaters operate with 45 Kw input which is automatically re-

Grieve-Hendry oven with recirculating blower.

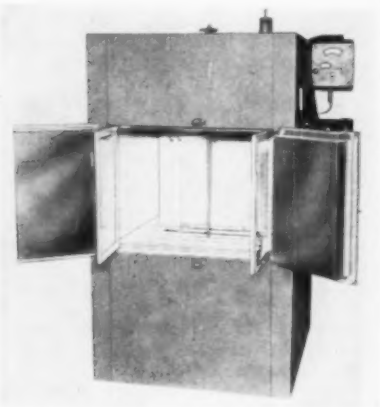
duced to 15 Kw when maximum oven temperature, 500° F., is attained. The doors at each end of the 48-inch high and 72-inch long work chamber are sealed with silicone rubber gasketing.

Readers' Service Item 25

Observation Testing Oven

A 450° F., vertical-flow, convection-heat, testing oven is equipped with inner glass doors. Thus, according to the producer, Despatch Oven Co., the operator may observe his products, such as baked finishes, without removing them from the oven. Seven revolving sample holders, hung on 7-inch rods from the top of the center shaft, further ease viewing.

The cabinet is available in stock sizes I.D. 24 by 24 by 18 inches to I.D. 38 by 42 by 45 inches. Any size may be ordered.



Testing oven with inner glass doors.

Readers' Service Item 26

Linear Viscometer

Determining the viscosity and flow characteristics of materials is reportedly simplified by using C. W. Brabender Instruments, Inc.'s Visco-Corder. Available with 15 paddle designs, the Visco-Corder measures viscosity of nearly all fluids such as epoxies, gels, plastisols, or pastes. Change in viscosity are automatically recorded. Since the instrument is linear, conversion from Brabender units to other viscosity units may be made.

The unit is available in three models: VC-1, 78 rpm., 11-volt, 60 cycle; VC-2, 100-200 rpm., (in nine steps), 110 volt, 60 cycle; and VC-3, 20-300 rpm. (stepless variable speed), 110 volt, 60 cycle or 220 volt, 3 phase, 60 cycle. Accessories include interchangeable sensitivity cartridges

DAVIS-STANDARD

More For Your Extrusion Money !

2½" thermatic* with HOBBS 44" "Versawind"

Complete D-S Blown-Film Package with Hobb's Wind-up

THE TOP PRODUCTION TEAM

- Model 25T thermatic Extruder
- Precision Rotative Crosshead Die
- High Capacity Air Ring and Blower
- Adjustable Tower
- Versatile, High-Speed 44" Winder by HOBBS MANUFACTURING COMPANY, Salisbury Street, Worcester, Mass.

"Package" pays-off in Profit

In order to get the most for your money in a blown film line, each component must be a top performer. That's why Davis-Standard recommends and sells Hobbs winding equipment as part of the complete blown film "package". The production capacity of the rugged Model 25T thermatic Extruder is unequalled by any competitive machine.

Our precision Rotative Crosshead Die is a natural outgrowth of recognized D-S superiority in crosshead technique for the exacting requirements of the wire industry for many years.

This "Package" of Davis-Standard and Hobbs machinery offers the blown film producer a complete set-up with performance and versatility to meet any tolerance requirements . . . and all from a single supplier!

*Patented

Get complete details today

D-S DAVIS-STANDARD

Division of FRANKLIN RESEARCH AND DEVELOPMENT CORPORATION

14 WATER STREET, MYSTIC, CONNECTICUT

EUROPE and the STERLING AREA — Fawcett, Preston & Co., Ltd. Bromborough, England (Mfg. Lic.)
MIDWEST — C. J. Beringer Co., 5667 Milwaukee Ave., Chicago 46, Illinois
WEST COAST — C-L Chemical Products Co., P.O. Box 3043, Santa Ana, California

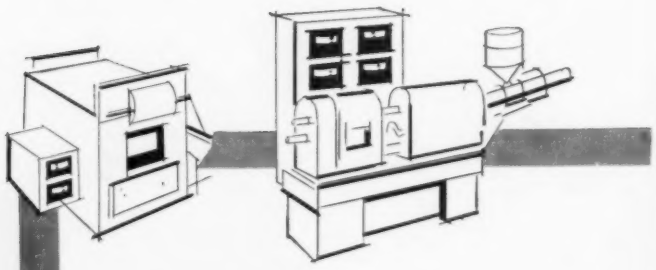
EXTRUSION MACHINERY FOR FILM · SHEETING · WIRE INSULATING
BLOW MOLDING · CONTOUR · COMPOUNDING

Why it pays to see that

WEST Instruments are in

Original Equipment

using Temperature Control



Makers say

"Our equipment sells best on performance, including ease of operation and maintenance. We can't risk dissatisfaction that stems from components, such as instruments. We're safer with Gardsman, by West, and their world-wide service."

Users say

"Instrumentation can be the key to overall efficiency of major equipment. West temperature controllers work better than most, definitely save on several counts . . . including initial cost. It pays to specify."

Whatever type of control—off-on, proportioning, high-limit, stepless, program—get the best: get West. *Tubeless.* Compact. Reliable. Ask your West representative or write for Bulletin COM.

WEST *Instrument* **CORPORATION**

SALES OFFICES IN PRINCIPAL CITIES

4359-C W. MONTROSE, CHICAGO 41, ILL.

British Subsidiary:
WEST INSTRUMENT LTD.,
52 Regent St., Brighton 1, Sussex
Represented in Canada by Rivers Automatic Controls, Ltd.

the trend is to WEST

C. W. Brabender Visco-Corder.

in cmgms from 1.25 to 2,000; and interchangeable and disposable paddles.

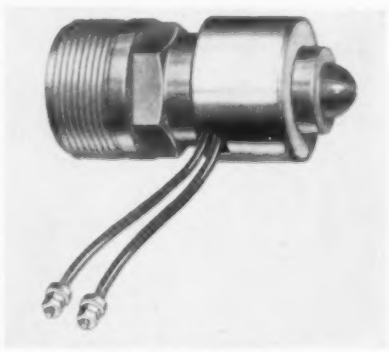
Readers' Service Item 27

Tubular Nozzle Heater

Thermel, Inc., has announced a Thermatube nozzle heater developed for nylon work and other applications requiring higher nozzle temperature. Totally enclosed in a stainless steel shell, the tubular heater has long cold terminals which can be bent by the user. Armored flexible extensions are available at extra cost.

Specifications of available stock sizes follow. Dimensions are in inches.

I. D.	Width	O.D.	Watts	Volts
1	1	1¾	125	115/120
1	1	1¾	125	230/240
1½	1½	2¼	300	115/120
1½	1½	2¼	300	230-240
1½	5	2¼	600	Dual
1¾	3½	2½	500	Dual
1¾	1½	2⅜	350	230/240



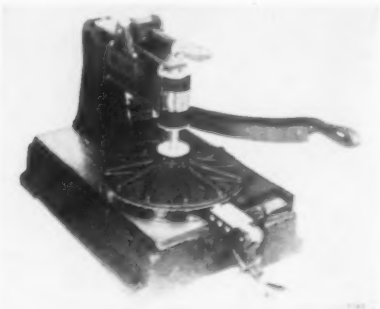
Thermatube nozzle heater.

Readers' Service Item 28

Square-Foot-Sample Cutter

The Thwing-Albert Four-Square Sample Cutter will prepare square-foot samples of sheet material. Mounted on a base is a rotating plate, indexed for four 90 degree positions. The sample is clamped to the plate by a disc of the same size attached to a movable shaft. The cutting blade is mounted on the right side of the base. After the material is clamped in position, the knife slices each edge as the plate is turned.

The base dimensions are 15 by 22 inches. Over-all dimensions, including handle extensions, are 16 by 30 by 26 inches.



Thwing-Albert Four-Square Sample Cutter.

Readers' Service Item 29

High-Speed Stress Tester

The Plastechon High Speed Tester will measure tensile, flexural, and compressive properties at any rate of loading from 0.2 inches per minute (static loading) to 8,000 inches per minute (shock loading).

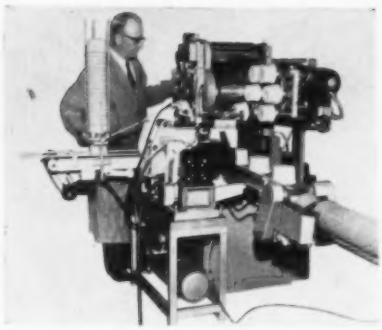
The apparatus, available from Plas-Tech Equipment Corp., consists of a mechanical test frame, a hydraulic section, and an electronic console housing a calibrating network, oscilloscope, and time marker. Load is electronically measured as a function of time or strain on the oscilloscope, and a permanent record may be made with a camera. In testing for ultimate strength, the specimen is stressed to failure within a few thousandths of a second.

The model is currently available in 2,500, 10,000, and 30,000 pound capacities.

Readers' Service Item 30

Automatic Printing Attachments

Cosom Engineering Corp. has developed automated feeders and take-off attachments for its Cosomatic flexographic printers. The custom-made attachments can be used on either the flatbed or rotary printers. In general, attachments for



Cosomatic Rotary Flexographic Printer.

the rotary printer will double the 48 by 37 inch floor space, while those for the flatbed printer increase its 106-inch length.

Readers' Service Item 31

Printed Circuit Board Holder

Macdonald & Co. is distributing the Little Joe No. 160 printed circuit board holder which adjusts to any working position. While Little Joe has a holding spread of up to 8½ inches, longer holder rods are available for greater widths. Boards are released by a knurled nut at the bottom of the holder rod. Aluminum clamps clasp boards firmly without damaging their edges.

Mounted on a steel base 4 by 6 by ½ inches, the unit is only 9 by 10 inches.

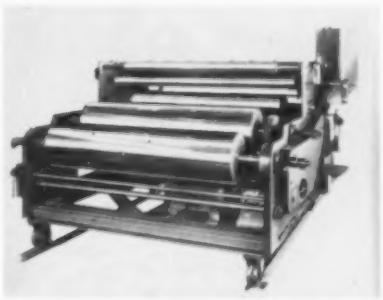
Little Joe Holder Model No. 160.

Readers' Service Item 32

Casting Roll Unit

A casting roll unit for plastic sheet and film said to eliminate poor clarity, dullness, wrinkling, puckering, gage variation, and poor temperature regulation has been introduced by Modern Plastic Machinery Corp. It is automatically compensated for line speed and instrumented with tachometers to show line, wind-up, and empty core speeds.

The unit can be supplied with two chrome-plated casting rolls with a maximum roll diameter of 18 inches. Tension control drive system, high speed cutoff knife, razor blade slitting, and turret windup will accommodate a 20-inch roll. A third chill roll can be incorporated, with refrigeration units. A 1½ hp motor with electronic speed control drives the rolls up to 500 fpm.



Model WSF-54 casting roll unit.

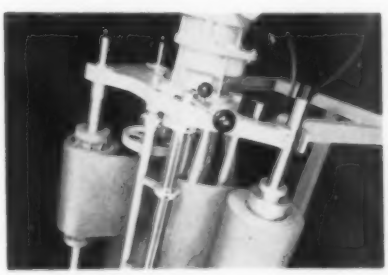
Readers' Service Item 33

Film and Sheet Slitter

The Kiefel Slitter for plastic films, sheets, and similar materials is being distributed in this country by Leedpak, Inc. Designed for short runs or low volume, the slitter may also be used to supplement heavier equipment during peak production periods.

The unit features friction control devices to provide proper tension, a yardage counter, interchangeable feed and take-up rolls, a gearmotor for control of cutting speeds, and a spring-action conical brake for the feed roller to eliminate backlash.

Measuring 83 by 24 by 40 inches, the slitter will handle material ½ to 58 inches wide and 0.003 to 0.03 inches thick. While maximum stock diameter is 10 inches, a special attachment accommodates diameters up to 18 inches. Maximum diameter of a slit roll is 10¾ inches. Cutting speed is approximately 80 feet per minute.



Short-run Kiefel Slitter.

Readers' Service Item 34

"... extra performance becomes one of the primary considerations in evaluating the cost of a plasticizer."

BURLSKIN®

James Geenty, Technical Director of the Goodall Vinyl Fabrics Div., Burlington Industries, says:

"My role as technical director of the Vinyl Fabrics Division carries many responsibilities. First, raw materials that we buy must give our coated fabrics the highest performance possible at a cost consistent with end use requirements. Of equal importance is plant operations. This includes reliability of supply to keep the plant running at full capacity with a minimum amount of working capital tied up in inventory. Also, all raw materials must process easily, and their processing characteristics cannot vary from shipment to shipment.

"In our experience, we have found that high quality plasticizers give us these advantages. So, the extra performance that they impart to our coated fabrics, plus processing advantages, becomes one of the primary considerations in evaluating the cost of a plasticizer. The use of high quality plasticizers is one of the factors responsible for the fine reputation of our Goodall Vinyl Fabrics."

Where the accent's on quality look for ***Plastoleins®***

Emery

Organic Chemical Sales Department

EMERY INDUSTRIES, INC., CAREW TOWER, CINCINNATI 2, O.

Vopcolene Division, Los Angeles; Emery Industries (Canada), London, Ont.
Export Department, Cincinnati

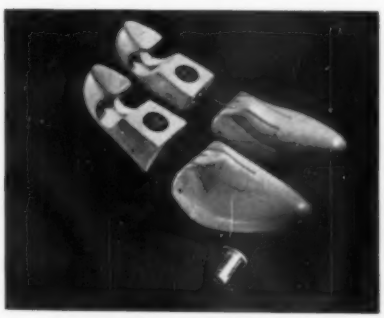
Plastics Applications

Write item numbers on Readers' Service Card (p. 107) to obtain more information.

Nylon Shoe Tree Button

Depression of a tough, lightweight nylon button is all that is necessary to adjust each shoe tree made by Jay Vee Shoe Tree Co. to the desired length. The button is molded of Plaskon Nylon 8200, reported to be highly abrasion-resistant and tough. Available in a wide range of colors, the button can be stamped with the retailer's logo-type.

Both Mac Full and Andy Half Trees, each available in four sizes which fit lengths 6-14 and widths A-E, are stocked for immediate delivery in natural basswood with black button. Both models are available in other colors at a slight extra cost.

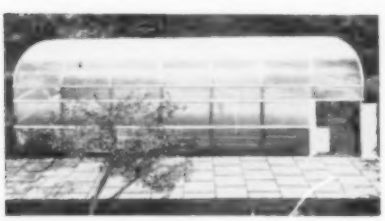


Jay Vee Mac Shoe Trees.

Readers' Service Item 41

Swimming Pool Housing

Through the use of International Swimming Pool Corp.'s Solaroof, a pool can be made into a year round recreation center. Constructed of aluminum extrusions, saran screening, and a polyethylene cover, the pool is reconverted for summer use by removal of the cover. Solaroof has effectively withstood simulated snow loads and low temperatures.



International Swimming Pool Corp.'s Solaroof.

Readers' Service Item 42

Nicholson file handle.

Plastic File Handles

File handles designed and produced of impact styrene by Danielson Mfg. Co. for Nicholson File Co. are reported to be comfortable to handle, light weight, and durable. The square orange and black handles are intended to facilitate correct grip.

Readers' Service Item 43

Redmanson 55-gallon drum and lid.

Polyethylene Industrial Drums

Redmanson Corp. is marketing a white polyethylene injection-molded 55-gallon drum and lid. Weighing only 10¼ pounds, the drums have a diameter of 24 inches and stand 31 inches high. The tight-fitting lids are fastened by a steel closure ring.

Molded by Federal Tool Corp.'s 300 ounce injection machines, the drums reportedly are noiseless, easily cleaned, acid and chemical resistant, sanitary, dentproof, rustproof, non-toxic, non-sparking, and durable.

Readers' Service Item 44

VINYL UPHOLSTERY PRODUCERS
who use
Plastolein 9720 Polymeric
have two unbeatable allies:

TIME—the final judge of quality. Plastolein 9720 Polymeric has excellent permanence, thanks to low volatility, low migration, and outstanding resistance to "wipe-off," heat and ultraviolet light. These qualities are a comfort to our customers because they *know* their products will far outlast competitive products using monomeric plasticizers.

COST—the powerful competitive edge. Plastolein 9720 is the *lowest cost* polymeric plasticizer on the market today. In addition, its relatively low viscosity makes processing easier and permits the economies of bulk shipping, storage and handling.

Why not get both these advantages on *your* side? Write Dept. Q-2 for booklet–"Plastolein Plasticizers"

PLASTOLEIN® plasticizers
Emery

Organic Chemical Sales Department
Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio
Vopcolene Division, Los Angeles
Emery Industries (Canada), London, Ontario
Export Department, Cincinnati

AT YOUR SERVICE

THE RESULTS OF 30 YEARS OF RESEARCH ON ORGANIC PEROXIDES

For over three decades we have specialized in the manufacture of organic peroxides. Today our peroxides are outstanding in quality and closely controlled uniformity. During all these years we have maintained a progressive program of research and development work for the purpose of making organic peroxides and their compounds available to industry in the form best suited to each particular application. We are confident that in the groups of organic peroxides listed below you will find the key to some of your processing problems.

Diacyl Peroxides **Dibasic Acid Peroxides**
Ketone Peroxides **Aldehyde Peroxides**
Alkyl Peroxides & Hydroperoxides
Alkyl Peroxyesters

Our Research and Technical Staffs invite your consultation.

WRITE FOR A COPY OF

1. "The Evaluation of Organic Peroxides in Terms of Half-Life Data." A paper resulting from Research by LUCIDOL.

2. "The Use of Organic Peroxides in the Reinforced Plastics Industry." A paper on proper method of storage and handling of organic peroxides.

3. New Bulletin covering our enlarged line of LUCIDOL Organic Peroxides.

LUCIDOL DIVISION
WALLACE & TIERNAN INCORPORATED
1740 Military Road
Buffalo 5, New York

Scotch brand Paklon film tape No. 681.

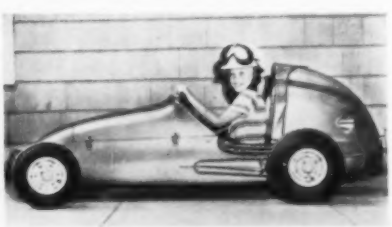
Transparent Film Tape

Paklon tape No. 681, a transparent, vinyl film-backed tape designed to resist water, acids, alkalis, and wide temperature ranges, has been introduced by Minnesota Mining & Manufacturing Co. The tape is reported to have high dimensional stability, which assures its resistance to damage by severe atmospheric conditions. Available in widths from ¼-43 inches and in lengths of 72 yards, the 2.8-mil tape has a tensile strength of 30 pounds per inch of width and can be dispensed without special cutting blades.

Readers' Service Item 45

Children's Racing Cars

Lunn Laminates, Inc., is currently producing contact-molded, fiberglass laminated bodies, hoods, and engine covers for children's gas-powered racing cars available from Larc-Douglas Co., Inc. Called the Offyette, the car is sold both in a disassembled kit and as a ready-to-run model. The Offyette is 79 inches long and has a wheel base of 49 inches and a wheel tread of 32 inches.



Larc-Douglas Offyette

Readers' Service Item 46

PRODUCTS
Can Grow Old Gracefully too

HARCHEM SEBACATE PLASTICIZERS WILL GIVE YOURS THIS UNIQUE QUALITY

Extend the life and the original looks of your products and you build customer good will that reflects itself in greater sales and profits. Nothing will give them more stability, more protection against the inroads of age than Harchem Sebacate Plasticizers. Whether you seek resistance to heat, cold, water, weather or physical abuse, the key to your problem can be found in the chart of four Sebacic Acid Esters found below.

Plasticizer	Specific Gravity 25°/25°C ± .003	Viscosity 25°C, cps	Compatible With	Outstanding Characteristics
Dibenzyl Sebacate	1.055	21-22	Polyvinyl Chloride and Copolymers, Polyvinyl Butyral, Synthetic Rubbers	Excellent Solvation, Very Low Volatility, Permanence, Good Electricals, Low Temp Flexibility
Dibutyl Sebacate	0.935	7.9	Vinyl Resins, Cellulose Acetobutyrate, Synthetic Rubbers, Rubber Hydrochloride, Polymethyl Methacrylate	Low Temp. Flexibility, Excellent Aging Qualities, Non-Toxic
Dimethyl Sebacate	0.986*	3.54 @30°C	Vinyl Resins, Synthetic Rubbers, Cellulose Nitrate, Cellulose Acetobutyrate, Acrylic Resins	High Solvency and Efficiency, Wide Compatibility, Concentrated Source of Sebacyl Radical
Dioctyl Sebacate	0.913	17.4	Polyvinyl Chloride and Copolymers, Polyvinyl Butyral, Synthetic Rubbers, Cellulose Nitrate, Cellulose Acetobutyrate	Excellent Low Temp. Flexibility, Low Volatility, Excellent Soapy Water Resistance, Good Electricals

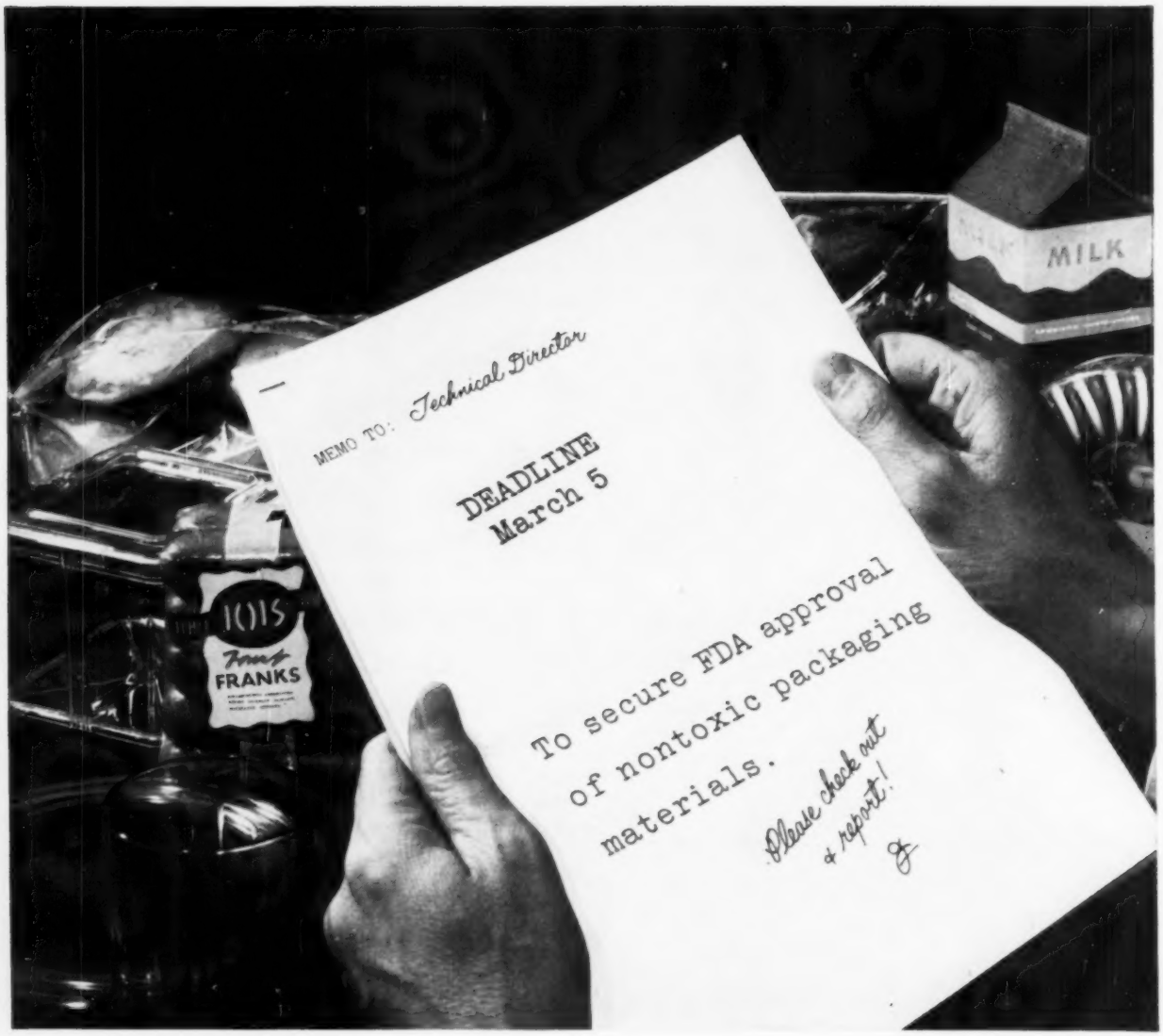
*30°/20°C

WRITE FOR BULLETIN OR CONSULT
CHEMICAL MATERIALS CATALOG PAGES 173-175

THE KEY TO HARCHEM® BETTER PLASTICS

HARCHEM DIVISION

WALLACE & TIERNAN, INC.
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY
IN CANADA: W. C. HARDESTY CO. OF CANADA, LTD., TORONTO



Simplify evaluation work. Specify use of **MONSANTO'S**

SEVEN FDA-APPROVED PLASTICIZERS

The 1958 Food Additives Amendment to the Federal Food, Drug, and Cosmetic Act requires extensive evaluation of many plastic packaging ingredients . . . including extraction tests, and possibly expensive, time-consuming spectrophotometry, radioactive tracing, and animal-feeding tests. Specification of a Monsanto *approved plasticizer* can help you minimize this problem.

Seven Monsanto plasticizers approved for nontoxic applications can give you more assurance of meeting FDA specifications—and also provide a broad range of properties to meet the most particular packaging requirements. *Five* Monsanto plasticizers (SANTICIZER 141, SANTICIZER E-15, SANTICIZER B-16, Monsanto di-isobutyl adipate and diethyl phthalate) have earned *complete acceptance* from the FDA for use in plastic packaging for aqueous, fatty or nonfatty foods.

By specifying use of these Monsanto *approved plasticizers*, you can be more certain that your packaging materials are toxicologically safe and comply with the 1958 Food Additives Amendment. Check the tables shown here. They're a convenient guide to industry's largest and most diversified line of plasticizers for nontoxic formulations . . . from Monsanto. For more details and a copy of the 1958 Food Additives Amendment to the Federal Food, Drug, and Cosmetic Act, just use the convenient coupon.

Plasticizer compatibility with six plastic materials

Monsanto Plasticizers	Polyvinyl Chloride	Polyvinyl Acetate	Cellulose Acetate	Ethyl Cellulose	Acrylic Type	Nitrile Rubber
Santicizer 141	C	C	SC	C	C	C
Santicizer E-15	C	C	C	C	C	—
Santicizer B-16	C	C	LC	C	C	C
Di-isobutyl Adipate (DIBA)	C	C	I	C	C	C
Diethyl Phthalate	LC	C	C	C	C	C
Dioctyl Phthalate (DOP)	C	SC	I	C	SC	C
Di-isoctyl Phthalate (DIOP)	C	SC	I	C	SC	C

C (Compatibility)—25-100 parts per 100 parts resin. LC (Limited Compatibility)—10-50 parts per 100 parts resin. SC (Slight Compatibility)—1-25 parts per 100 parts resin. I (Incompatible)

Job-rated plasticizer performance (where "1" is best, based on typical results)

Monsanto Plasticizer	Non-Toxicity	Low Volatility	Grease & Solvent Resistance	Water Resistance	Low Temperature Flexibility	Low Cost
Santicizer 141	1	1	1	2	2	1
Santicizer E-15	1	4	1	3	3	2
Santicizer B-16	1	2	2	3	3	2
Di-isobutyl Adipate (DIBA)	1	3	2	3	1	2
Diethyl Phthalate	1	5	1	2	3	1
Dioctyl Phthalate (DOP)	X	1	3	1	2	1
Di-isoctyl Phthalate (DIOP)	X	1	3	1	2	1

X—Accepted for use with foods of high water content only.

FOR NONTOXIC PLASTIC APPLICATIONS

Informative Booklet on Nontoxic Plasticizers Now Available

Gives specific advantages in numerous applications, describes outstanding features and lists specification properties of seven Monsanto nontoxic plasticizers. For your copy, use the convenient coupon.

•

With no bias in favor of a single nontoxic plasticizer, Monsanto develops plasticizing systems custom-made to fit your needs best.

Santicizer: Monsanto T. M., Reg. U. S. Pat. Off.

Monsanto

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
Plasticizer Dept. 1B, St. Louis 66, Missouri

Please send the booklet, "Seven Monsanto Plasticizers for **Nontoxic** Applications," plus a copy of the 1958 Food Additives Amendment to the Federal Food, Drug and Cosmetic Act.

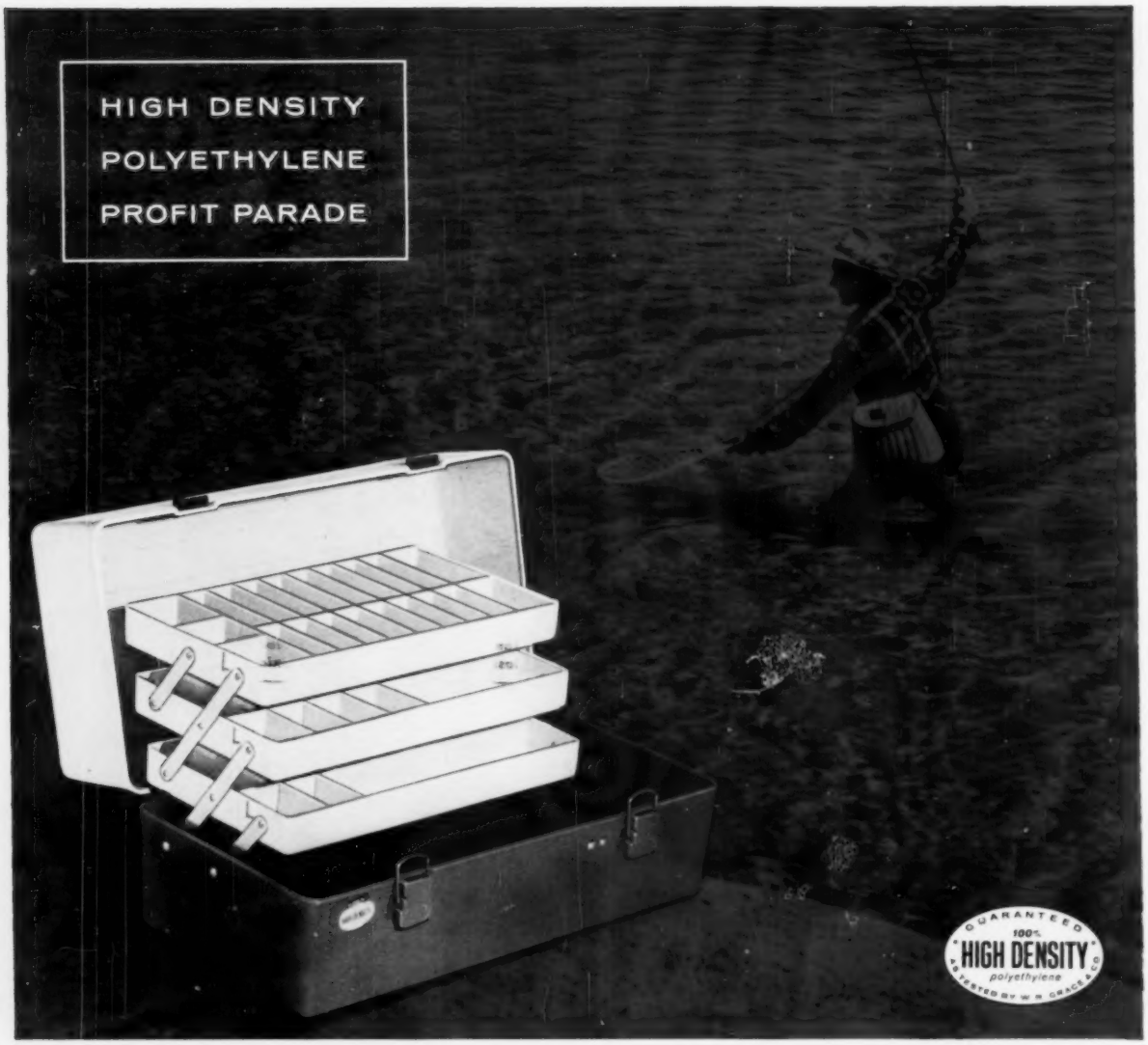
Name .....

Company .....

Address .....

City ..... *Zone* .....

State .....



Fishing Tackle Maker Gets a New Angle on Plastics

Many manufacturers are now looking to Grex high density polyethylene for new products and new profits. One such company is B. F. Gladding Co., Inc., manufacturers of quality fishing lines since 1816. Gladding's choice of the Grace plastic for a new line of tackle boxes marks a major innovation in the company's products.

To Gladding, high density polyethylene has proved to be a truly remarkable material. The Gladding Grex Tackle Boxes are tough and rigid—withstand the roughest treatment without breaking, shattering, cracking or denting. Drop one in the water, and it floats. Spill battery acid, oil, gasoline, bug repellents or silicones on the box. Such chemicals—normally harmful to other materials—wipe clean from Grex without staining, softening or marring the finish. Changes in temperature or weather will not cause warpage. Salt water will not corrode. These new boxes will still look new even after seasons of rugged use.

What more could a fisherman want? Or for that matter, what more could you want in a high grade plastic that can be economically fabricated to keep manufacturing costs down and profits up? Find out more about high density polyethylene by calling in the experts. Grace has the production facilities, technical service and experience to help put your product in the Grex profit parade. Everyone says we're easy to do business with.

Grex is the trademark for W. R. Grace & Co.'s Polyolefins.

W.R. GRACE & CO.
POLYMER CHEMICALS DIVISION CLIFTON, NEW JERSEY

Can high density polyethylene be used in existing molds?

Of the seven molds used to produce Gladding's tackle boxes, six were originally built for a material other than high density polyethylene. Modifications were required in cooling and gating.

Proper cooling. When designing molds for high density polyethylene a prime consideration is to obtain as small a temperature gradient as possible across the face of the mold. In this case, additional channels were cut into the molds, flow of existing channels was changed and bubblers were put opposite each gate. These modifications served to bring the coldest water closest to the hottest material for more uniform cooling.

Conversion to multi-gating. The molds as originally built utilized a single direct sprue gate. This system was changed to multi-gating by the use of a hot runner which provided better control over material temperature. With smaller sprues, the need for three-plate mold construction was eliminated and valuable daylight was saved for easier removal of parts.

As a general rule, proper cooling and gating of molds for high density polyethylene can pay off on four counts: (1) control of warpage and shrinkage, (2) faster cycles, (3) reduction in induced stresses and strains, (4) greater uniformity in density of molded parts.

Do we know all the answers? We have the experience with high density polyethylene on our side—and are learning more every day. Grace has solved problems involving all types of molding, from toys weighing a few ounces to pieces of three and four pounds. Our Clifton Laboratories are equipped to handle almost any molding job. We sincerely want to place our experience and facilities at your command. If you have an application for high density polyethylene, now's the time to contact:

Technical Service Department
W. R. Grace & Co., Clifton, N.J.

Plastics Applications (Cont'd.)

Jar and Bottle Opener

A Geon vinyl opener for removing screw caps of containers ranging in size from catsup bottles to mason jars has been introduced by W. L. Gill Co. Conically shaped to fit the hand, the opener is about 3¾ inches in diameter and two inches deep.

Each of the five interior circular ledges of graduated diameter has a row of tooth-like projections to grip the cap. The outside is knurled. Injection molded from B. F. Goodrich Chemical Co. vinyl, the opener is available in red, blue, yellow, and green.

Geon vinyl screw cap opener.

Readers' Service Item 47

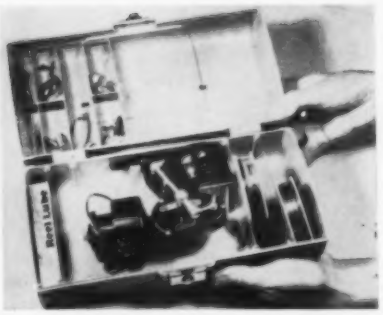
Nylon Dust Guard

To protect railroad freight car journal boxes from dirt contamination and oil loss, DO Co. has developed a Plaskon nylon dust guard. The guard is claimed to take all impact while retaining its original shape and snug fit on the dustguard seat. The DO guard comes in car sets of eight in sizes 5½ by 10 inches, 5 by 9 inches, and 6 by 11 inches.

Plaskon nylon is supplied by the plastics and coal chemical division of Allied Chemical Corp.

DO nylon journal box dust guard.

Readers' Service Item 48



Garcia Corp. tackle box.

Impact Styrene Tackle Box

Garcia Corp. is now packaging its Mitchell 300 and 304 spinning reel and accessories in an injection molded high impact styrene tackle box. Molded in black, red, and gray by Jamison Plastic Corp. of Catalin Corp. of America styrene, the tackle box has movable dividers and a special slot and protective pad for the reel.

The box is available with a reel and balanced selection of sinkers, hooks, and other equipment, or as a separate item.

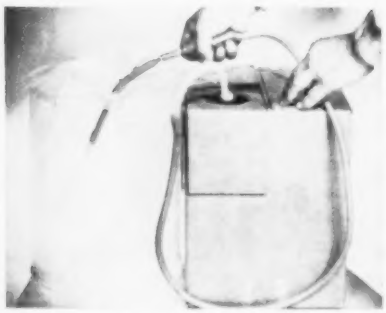
Readers' Service Item 49

Stearns Aquafoam Lifeguard.

Vinyl Sponge Lifejacket

Ensolite, a buoyant, closed-cell vinyl sponge made by U. S. Rubber Co., is used by Stearns Mfg. Co. for a lifejacket which automatically rights the wearer, keeping his head above water. The Aquafoam Lifeguard is secured over the upper half of the body by a strap. Light in weight, it is available in three sizes and several colors and patterns.

Readers' Service Item 50



The Jasperdrum in operation.

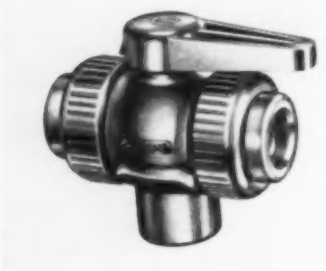
Recloseable Container

A five-gallon polyethylene container, self-contained in its own fibreboard box, has been introduced by Jasper Bag, Inc. Intended for one trip shipping of liquid chemicals or foods, the Jasperdrum is made of Chippewa Plastics Co. polyethylene. Bottom and sides are 12 mils and the top is 15 mils. A specially modified Rieke Flex-Spout, using a sealing plug rather than a built-in diaphragm, is heat sealed to the container. A special siphon device is also available.

Readers' Service Item 51

Three-Way Valves

Chemtrol has announced a three-way valve, in Type I and Type II PVC, designed for systems handling corrosive liquids. Feeding to the inlet, flow can be diverted in either of two directions or shut off. Presently available in combinations of ½-, ¾-, and 1-inch ports, the valves have Teflon valve seats, quad-type ring seals, and may be obtained with threaded IPS connectors or sockets for solvent welding.



Chemtrol three-way PVC valve.

Readers' Service Item 52

Acoustical-Lighting Laminate

Soundsheet, a laminate of porous cellulose film about a core of rigid vinyl sheet, is reported to combine desirable acoustical and light diffusion qualities. Manufactured by Contrex Co. using Union Carbide Plastic Co.'s Bakelite vinyl, Soundsheet comes in flat and corrugated sheets, 0.013-inch thick, 35⅝ and 47⅝ inches wide.

Corrugated Soundsheet ceiling.

Corrugated Soundsheet has a noise reduction coefficient of 0.70. Light transmission of both corrugated and flat sheets is a standard 48%. For optimum light transmission, a space of 18-36 inches should be left behind the sheets.

Soundsheet comes transparent or opaque, and is printable. Acoustical quality is achieved by perforating the vinyl sheet with small, evenly-spaced pores.

Readers' Service Item 53

NEW

REVOLUTIONARY, VERSATILE, DIE-CUTTERS AFFORD MANY IMPROVED ADVANTAGES

Model No. D2436 HSX

TRONOMATIC*

Extra High Force...Air Hydraulic, Heat Assist Die Cutting Presses

Tronomatic engineering has created this new approach to improved die-cutting. By combining controlled heat with High force, at speeds comparable to mechanically-operated presses, it allows almost unlimited cutting die lengths. Can cut 1000" steel rule on .010" acetate...or 400" of oriented styrene. Accommodates both sheet plastic and complete multiple blister, or skin package cards. Single micrometer stop, adjustable to .005", protects dies, allows scoring and multi-plane cutting.

Low Die Costs
Low Maintenance Costs
High Quality Production
High Operating Safety

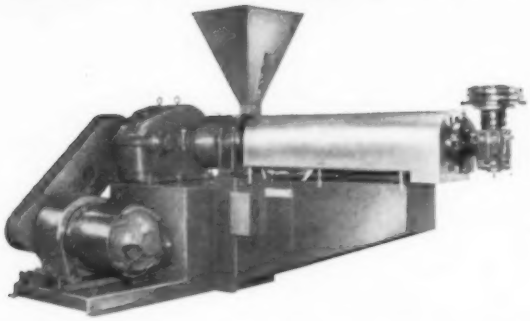
Available In 4 Standard Sizes or Custom Engineered For Your Needs. 24" x 36" Press is available up to 50-tons. Larger press capacity in excess of 100-tons in standard sizes, including 30" x 50", 40" x 60" and 48" x 72". High speed indexing and single or double. Shuttle table available for efficiency of operation. Heat-assist cutting allows near unlimited cutting capacity.

TRONOMATIC

Tronomatic Machine Manufacturing Corporation
1881 Park Avenue, New York 35, N. Y. • Sacramento 2-4611

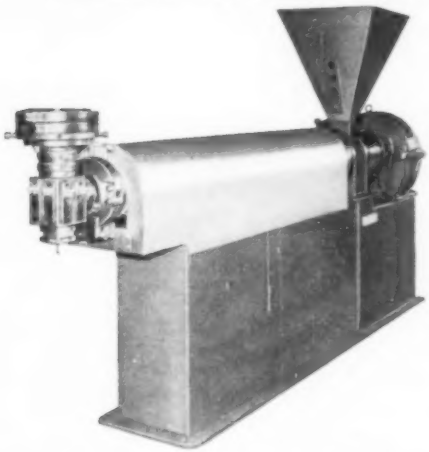
Now! New!... See our all-new line of thermoplastic sheet forming equipment . . . Booth 1438, AMA Packaging Show

STERLING



The Sterling Extruder is a superior product which only long experience in the plastics industry could have made possible. Sterlings are available in 1½" through 6" sizes with L/D ratios of 21:1, 24:1, or 30:1.

PERFORMANCE



There are also available—completely packaged units and installations for a variety of standardized and specialized requirements. For full details, write today to Mr. L. D. Yokana, President, Sterling Extruder Corp'n. 1112 Baltimore Avenue, Linden, N.J. WAbash 5-3908.

SERVICE

PRODUCTION

STERLING EXTRUDERS — *"Designed by plastics men for plastics men"*

New Literature

Write item numbers on Readers' Service Card (p. 107) to obtain more information.

"Rosite Custom Engineered Plastic Moldings." Bulletin No. 200. Rostone Corp. 8 pages. Rosite cold- and hot-molded plastic compounds are available for continuous temperature operation as high as 700° F. Uses, physical and electrical properties, and descriptions are offered.

Readers' Service Item 61

"Polyethylene . . . The Best Line Wire Covering." U. S. Industrial Chemicals Co. 4 pages. The bulletin compares polyethylene, neoprene, and URC for their various line wire covering applications. Two tables present properties of polyethylene and neoprene, and nominal weights of wire and cable in pounds per 1,000 feet of wire.

Readers' Service Item 62

"Plastics Catalog and Price List." Catalog No. 2. Cadillac Plastic and Chemical Co. 16 pages. Fiber glass fabrics and fibers, polyester and epoxy resins and catalysts, parting agents, pigments, and other supplies for reinforced plastics are listed with available sizes, grades, prices, and short descriptions of properties and recommended uses.

Readers' Service Item 63

"Kaykor Rigid Polyvinyl Chloride." Catalog RV-59. Kaykor Industries, Inc. 23 pages. The catalog describes rigid PVC products (plate, joining accessories, extrusion, bolts and nuts, and calendered sheeting), their properties, and applications. Directions for fabricating end products are featured.

Readers' Service Item 64

"UPVC Pipe Fittings, Flanges, and Valves." AIA File No. 29-B-8. Tube Turns Plastics, Inc. 23 pages. Unplasticized PVC drainage fittings may be used for piping industrial, sanitary, and educational facility wastes. Specifications for drainage fittings and procedures for assembling UPVC joints are given.

Readers' Service Item 65

"Piccoflex." Bulletin #P-12-91-1-5-59. Harwick Standard Chemical Co. 1 page. Typical physical properties, solubility, and applications of this high molecular weight coating resin are tabulated.

Readers' Service Item 66

"Properties and Use of Atlac 382 Polyester Resin." "Room Temperature Curing System for Atlac 382." Atlas Powder Co. 12 pages, 11 pages. The first bulletin contains instructions on using the resin and curing at elevated temperature. Also included are tables of chemical resistance, gel and reactivity times at various bath temperatures, properties of glass mat and cloth laminates, and viscosity graphs. The second bulletin describes the room temperature curing system for this resin, involving a catalyst, methyl ethyl ketone peroxide, and two accelerators—cobalt naphthenate and dimethyl aniline.

Readers' Service Item 67

"Nacreous Pigment Handbook." Mearl Corp. 8 pages. A comprehensive guide to the use of natural pearl essence and synthetic pearl pigments. Processing problems analyzed include dispersion and orientation of pearl crystals, choice of pigment types, formulations, and application procedures. Reference tables designate properties, characteristics, and uses of Mearl pigments.

Readers' Service Item 68

"Plastic Tooling Foundry Equipment." Bulletin T24A. Houghton Laboratories, Inc. 6 pages. This bulletin describes Hysol tooling materials and techniques for use in a duplicating process eliminating double shrink patterns. This epoxy system may be applied by laminating, casting, or a combination of the two.

Readers' Service Item 69

"Hetrofoam 16-17." Preliminary Technical Bulletin No. 14. Hooker Chemical Corp. Formulation and preparation of rigid fire resistant polyurethane foams from Hetrofoam 16-17, an alkyd resin system, is presented. Typical properties of the resin, prepolymer, and cured foam are included.

Readers' Service Item 70

"Plastic Products of the Dow Chemical Co." Dow Chemical Co. 8 pages. Listed in this booklet are the formulations, characteristics, properties, and uses of Dow monomers, coating latexes and resins, molding and extrusion compounds, foamed products, flexible films and sheeting, and building products.

Readers' Service Item 71

"Production Proven!" Essex Plastic Machinery Co., Inc. 10 pages. Individual sheets illustrate, describe, and list detailed specifications of the company's extruder, nip roll take-off, web edge guide, take-up turret winder, and hi-frequency printability treater.

Readers' Service Item 72

"Fabrication of Plexiglas." Commercial Plastics & Supply Corp. 32 pages. The booklet describes Plexiglas and, by text and illustration, provides directions on how to design with, form, cement, machine, finish, clean and maintain, and anneal acrylics. It concludes with a reference guide to sources of supply for fabricating equipment and materials.

Readers' Service Item 73

"Cycolac ABS Polymers for Pipe and Pipe Fittings." Pipe Bulletin No. 1. Marbon Chemical Division, Borg-Warner Corp. 7 pages. This report features technical data and laboratory reports dealing with the outstanding properties of Cycolac ABS copolymers for piping applications.

Readers' Service Item 74

"How to Buy Plastics Custom Molding." Plastics Division, Monsanto Chemical Co. 4 pages. This guide to management features a questionnaire intended to assist the manufacturer in deciding whether he can benefit from custom molding. Factors to be considered in making this decision complete the pamphlet.

Readers' Service Item 75

"Modern Thermoplastic Extrusion Equipment." Modern Plastic Machinery Corp. 4 pages. This folder describes and illustrates vented and non-vented extruders, casting roll units, sheeting lines, and dies. Specifications are included.

Readers' Service Item 76

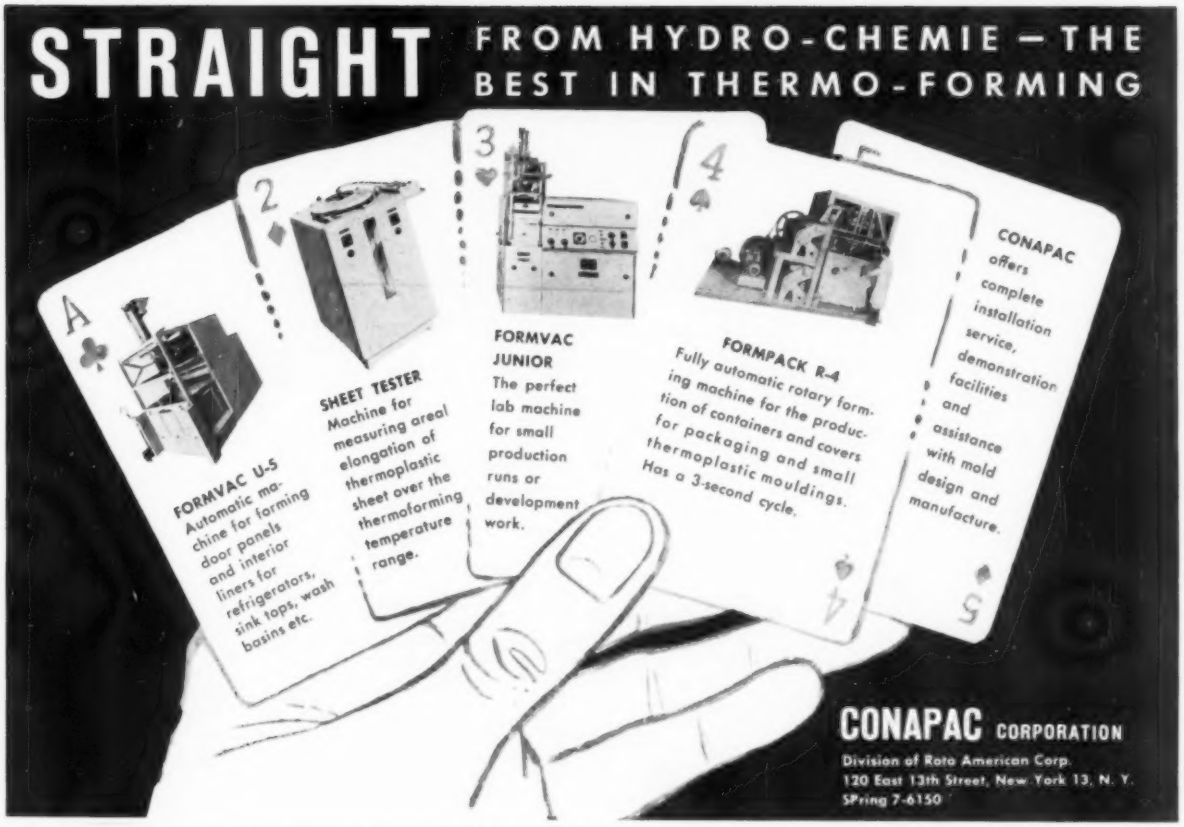
"Tensile Tester Grips." Bulletin 101-TT. Thwing-Albert Instrument Co. 4 pages. Brief descriptions, specifications, and drawings of Tappi grips, general purpose grips, Finch wet strength device, Finch edge tear stirrup, and Clark zero span grips are included.

Readers' Service Item 77

"Heat Erosion Characteristics of Reinforced Plastics." Bulletin No. 2.15. Zenith Plastics Co. 3 pages. Describing the properties of reinforced plastics as ablation materials, the bulletin draws conclusions about the comparative suitability of several different resin systems. A table of erosion rates at high temperatures is given.

Readers' Service Item 78

STRAIGHT FROM HYDRO-CHEMIE — THE BEST IN THERMO-FORMING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Reviews

"Technology of Instrumentation." Eric B. Pearson. D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. Cloth, 5½ by 8¾ inches, 202 pages. Price, $4.75.

Intended as an introductory text to the study of instrumentation, this volume nevertheless requires extensive knowledge of mathematics and engineering for its appreciation. Its lesson is: how to design an instrument which will measure a variable quantity accurately and consistently.

Concerned largely with the accuracy, characteristics, criteria, and performance of simple and complex servomechanisms, Pearson commences with a discussion of the elements of measurement as a science and basic characteristics of measuring instruments. He also spends some time on instrumentation of control processes and mathematics.

The text is amplified by black-and-white line drawings and flow diagrams.

"Vis-Tec Comparator." Visualized Technical Sciences, Inc., Dept. A-31, Box 43-064, Los Angeles 8, Calif. Price, $6.00.

This reinforced plastic device in the form of a large sliderule allows rapid comparison of specific properties of 12 proprietary laminate materials. On the reverse side are charts and tables compiled from military and manufacturer's data coordinating design criteria for evaluation of laminate systems.

The comparator was developed by engineers at Douglas Aircraft Co., Inc., which owns the copyright, under sponsorship of Owens-Corning Fiberglas. It will save the designer time by eliminating many references to manufacturers' literature and enable the user to evaluate product use efficiently.

"Silicones." Robert N. Meals and Frederick M. Lewis. Reinhold Publishing Co., 430 Park Ave., New York 22, N. Y. Cloth, 5¼ by 7½ inches, 267 pages. Price, $5.95.

One of the newest families of synthetic materials, silicones are probably best known to the plastics industry as mold lubricants. In this book, Meals and Lewis introduce the properties, chemistry, manufacture and fabrication, and present and potential applications of silicones.

Most present uses of silicones depend upon one or more of the following characteristics: thermal and oxidative stability at high temperatures; elasticity and flexibility at low temperatures; lubricity; surface properties; inertness; incompatibility; and non-conductivity. The three principal kinds of silicones, fluids, elastomers, and resins, each have different properties. The fluids are noted for water repellency, compressibility, inertness, stability, and relatively small change of viscosity with temperature. Their special ability to break foams is not understood. Silicone resins, often laminated with glass fiber or cloth, or flake mica reinforcements, may be molded, foamed, or applied as a coating. Silicone fluid polymerized with ferric chloride in the presence of hydroxy catalysts forms a peculiar bouncing putty.

Some of the hundreds of applications for silicones fall into categories of molding, extrusion, and laminating; wire and cable; release; insulation; protective coatings; antifoam; adhesives and sealants; and paper and fiber treating.

"Standardization—What's In It For Me?" American Standards Association, Inc., 70 E. 45th St., New York 17, N. Y. Paper, 8½ by 11 inches, 128 pages. Price, $4.50.

The theme of the Ninth National Conference on Standards of the American Standards Association, expressed in the keynote address by H. Thomas Hallowell, Jr., is that standardization produces not only financial, but intangible, savings. Not only will investments in standardization multiply in return, but petty arguments and lengthy conferences will be eliminated.

Other papers presented at the conference, held at the Hotel Roosevelt, New York City, in November 1958, echo the theme. Topics include standardization on national and international levels, with series devoted to the nuclear, machine tool, textile, hazardous chemical, electronic, and photographic industries. Standardization of test methods, specification preparation, and nomenclature are outlined in Alfred C. Webber's "Keeping Order Among the Plastics."

Most of the papers are brief, running only one or two pages. Avoidance of technical language permits understanding by the layman.

"Journal of Applied Polymer Science." I, 1, Jan.-Feb., 1959. Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y. Paper, 8 by 10½ inches. Price, $35.00 per year.

Edited by L. Bateman, H. Dillon, H. Mark, M. Morton, and F. Patat, assisted by an international advisory board, this bi-monthly journal is concerned with original research in the chemistry, biochemistry, and physics of large molecules. Each paper is followed by a bibliography and synopses in English, French, and German.

Topics covered in the first issue include PVC emulsions, structure of polystyrene, thermal antioxidants for polyethylene, orientation of polyethylene film, and impact strength of linear polyethylene. A letters to the editors column, this time devoted to polyvinyl alcohol, is reserved for the prompt publication of new facts or ideas of great scientific or technical significance.

Papers are illustrated, in accordance with the subject, by line drawings, figures, or half-tones.

Abstracts of Important Articles

Materials

"Polyamides as Industrial Material and Semi-Manufacture," H. Peckhaus, *Plastverarbeiter*, 9, 5, 172 (May 1958).

Brief description of various polyamides covering their properties, applications, methods, of machining, and finishing of semi-manufactures. (In German.)

"A Unique Modifier," H. D. Barnstorff, H. D. Cummings, J. A. Cannon, and A. Y. Coran, *SPE J.*, 15, 10, 873 (Oct. 1959).

Description of a new additive for epoxy resins.

"Refractive Index Method for Determining Cure Rates of Epoxy Resins," Hans Dannenberg, *SPE J.*, 15, 10, 875 (Oct. 1959).

A method for testing cure performance of epoxy resins and curing agents.

"Designing Rigid Urethane Foams for Low Moisture Permeability," C. M. Barringer, *SPE J.*, 15, 11, 961 (Nov. 1959).

The various factors that govern manufacture of such foams.

"Plastic Foams—A Directory," C. R. Davall, *SPE J.*, 15, 11, 955 (Nov. 1959).

A brief review of plastic foams available.

"Impact Thermoplastics: Which One to Use," M. W. Riley, *Materials Design Eng.*, 50, 6, 123 (Nov. 1959).

Thermoplastics suitable for impact uses are outlined and significant properties given.

"Tertiary Amine Catalysts: How They Affect Foam Properties," G. T. Gmitter, E. E. Gruber, and R. D. Joseph, *SPE J.*, 15, 11, 957 (Nov. 1959).

The laminates' shrinkage is shown to tion for polyester urethane foams.

"Vinyl Chloride Polymers: Their Design and Application," B. S. Dyer, *Trans. Plastics Inst.*, 27, 69, 84 (June 1959).

With the consideration in view that a vinyl chloride polymer must be made with the particular application in mind, the author discusses how the polymer can be suitably designed for its purpose. He explores the general possibilities of the molecular geometry of the polymer, the physical forms of the polymer particles, the presence of materials other than the polymer itself, and then illustrates their use by the specific examples in the production of phonograph records, premixes, pastes, and a PVC-coated glove by the paste-dipping process.

"Semi-Rigid PVC," Ulf Jacobson, **Brit.** *Plastics*, 32, 4, 152 (April 1959).

This paper, originally read in Swedish at the Swedish Plastics Federation Convention in Stockholm last year, describes tests carried out on suspension PVC of different molecular weights to determine the effects of small amounts of plasticizer on their properties. It was shown that the crystallinity of the PVC molecule changes with varying plasticizer content, the effect depending on the polarity and solvating ability of the plasticizer used. With small quantities of plasticizer, feebly solvating, low-temperature types like the sebacates and adipates give finished products with the best properties. It is difficult to predict the effect of plasticizer in processing semi-rigid PVC, because of rheological and other effects consequent on high working temperatures; but there are wide fields for semi-rigid PVC, though much work still has to be done.

"Determination of Resin Content of Phenolic Molding Powders," H. Wallhausser, *Kunststoffe*, 49, 4, 171 (April 1959).

The author describes a method in which the resin content values of both Novolak and Resol molding materials are determined by using cyclohexanone resins as the extraction agent. Results, which are sufficiently exact for practical purposes, are obtained in 8-10 hours as against 2-3 days by the DIN method using acetone extraction. (In German.)

"Impact Testing of Thermoplastics," D. R. Reid and R. A. Horsley, *Brit. Plastics*, 32, 4, 156 (April 1959).

Izod, Charpy, and falling-weight tests were carried out on materials including rigid PVC, polystyrene, cellulose acetate, cellulose nitrate, polymethyl methacrylate, high-density polyethylene, rubber-modified PVC and polystyrene, and styrene-acrylonitrile rubber. To compare and evaluate the usefulness of these tests as a general guide to the behavior of a particular material, certain test parameters were varied a wide range. Results demonstrated th tionships between the tests, and why rials are placed in differing ord increasing impact strength by the tests. They emphasize that satisfact plication depends on both impact s and notch sensitivity. It is conclud when tests are made carefully and interpreted correctly for the propos use, standard impact tests yield mu able information.

"Comparison of Molecular We tribution in Two Samples of P Methacrylate," M. Daune and L *Ind. Plastiques Mod.*, 11, 4, 3 1959).

Tests are described by which be shown that the marked diff mechanical properties of two s polymethyl methacrylate having mately the same molecular weig trinsic viscosity was due to a d distribution of molecular weight ple with the better molding ch was found to have widely dist weight molecules which are as plasticizer for the high w cules. (In French.)

"Allowable Working Stre PVC Pipes," A. A. van der *& Plastics Age*, 40, 2, 156 (F

After referring to long-ter periments carried out on sam PVC pipe by Buchmann in fining his "Dauerstandfestigk fined as: long-term load deformation of only a few pe the author discusses metho of experiments on rings c pipes, started in the Nethe and still in progress.

"Control of Thermal H ethylene Test Specimens," and A. Rudin, ASTM B pg. 63 (Dec. 1959).

Test method is describe the results obtained.

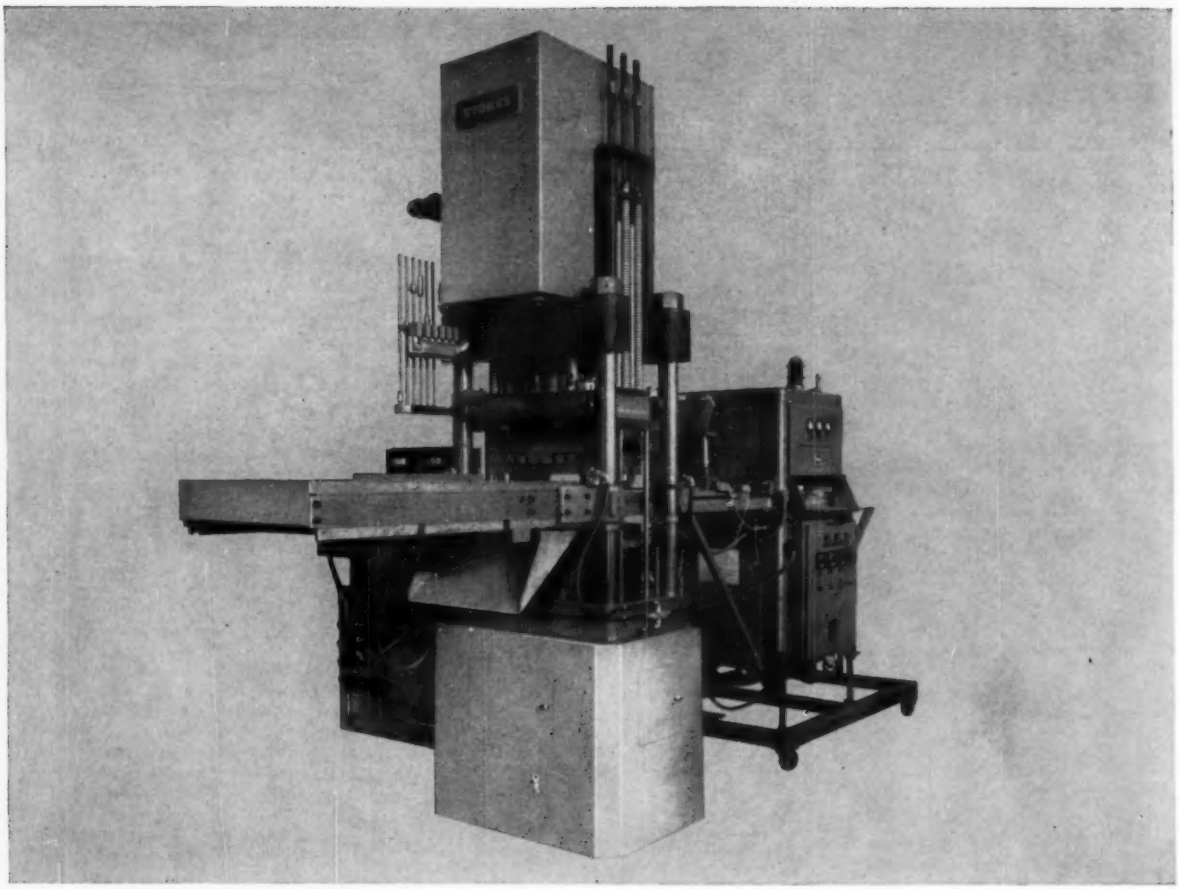
Equipment

"New Closure for No Molding of Thermoplas 49, 4, 199 (April 1959)

A new injection nozzl the closing pin on the angle, thus insuring goo trouble-free operation.

"Rheological Design Dies," G. Schenkel, *Ku* 49, 5, 252 (April & M

A number of exam show to what a limite



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so far proposed for extrusion heads for blown film, for sheathing wires and cables, and for pipe and tubing meet practical requirements. Neither the problem of diversion, nor that of avoiding longitudinal marks caused by the mandrel support have found a satisfactory rheological solution so far. A new type of diversion head is then described, its principles discussed, and a simple method of avoiding marks from the mandrel support offered. (In German.)

"Instrumentation and Control to Increase Output of Extruders," E. O. A. Mange, *Kunststoffe*, 49, 4, 166 (April 1959).

It is shown how use of constant weight or temperature of charge and heat acting on the extruder reduces the remaining variables in the extrusion of pipe and profile to a tolerable minimum, so that frictional heat and pressure build-up can be regulated by the easily-controllable rotational speed. In this way, output is also improved, both quantitatively and qualitatively. The take-off problem also is discussed, and a device for measuring and controlling wall-thickness is described. (In German.)

Applications

"Building with Plastics," V. H. Wentworth, *Plastics (London)*, 24, 259, 123 (April 1959).

Before plastics can be used in the building industries with the same confidence as timber and metals, their limitations and advantages must be appreciated. This requires coordinated thinking on the part of producer and consumer. How and where plastics already have been applied in buildings and construction in America and Britain, and the possibilities for further development are discussed, as well as the question of costs.

"Plastics as Construction Materials in the Steel Industry," Joseph Bigos, *SPE J.*, 15, 11, 957 (Nov. 1959).

Uses are shown to be in combination with steel.

"Use of Thermoset Laminated Plastics in Electronic Applications," P. V. Brown, *SPE J.*, 15, 11, 974 (Nov. 1959).

The laminates shrinkage is shown to depend on moisture content.

"Plastics in the Auto Industry," R. H. Dean, *SPE J.*, 15, 11, 968 (Nov. 1959).

A brief introductory paper on the subject.

General

"Laminates with Jute," J. Torrilhon, *Ind. Plastiques Mod.*, 11, 3, 33; 11, 4, 35; 11, 7, 49 (March, April & June 1959).

Following the introductory article on "Blast Fibers for Low Pressure Laminates" (January 1959, p. 51), the author discusses the method of testing the bending strength of the fiber, the properties of the different types of woven and non-woven jute fiber plies, the disadvantages of jute preforms, and the preparation and testing of non-woven jute/phenolic laminate. In considering the possibilities of these laminates, he suggests that their manufacture might be of special interest for the tropical countries both because the process is simpler than for resin/glass laminates and because they have the jute. (In French.)

"Commercial and Cost Considerations in Injection Moldings," A. B. Merriam, *Trans. Plastics Inst.*, 27, 68, 51 (April 1959).

The author considers the question of selecting and planning a job, discussing the main factors in factory costs—materials, labor, overhead, contingent costs, and tools.

Requests for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. The publishers and their addresses are given below:

"Applied Plastics"
The Scientific Press, Ltd.
11 Gloucester Road
London, S.W. 7, England

"ASTM Bulletin"
American Society for Testing Materials
1916 Race St., Philadelphia 3, Pa.

"Australian Plastics"
Australian Trade Publications, Ltd.
243 Elizabeth Street, Suite 406,
Sydney, N.S.W., Australia

"British Plastics"
Iliffe & Sons, Ltd.
Dorset House, Stamford St.
London, S.E.I., England

"Canadian Plastics"
341 Church St., Toronto, Ont., Canada

"Chemical and Engineering News"
1155 Sixteenth St. N.W.
Washington 6, D.C.

"Gummi & Asbest"
A. W. Gentner-Verlag
Forsterstrasse 131, Postfach 688
Stuttgart, W. Germany

"Hule Mexicano y Plasticos"
Filomeno Mata 13-11, Mexico, D.F.

"Industrial and Engineering Chemistry"
1155 Sixteenth St. N.W.
Washington 6, D.C.

"Industries des Plastiques Modernes"
Les Publications Techniques Associees
40 Rue du Colisee, Paris 8e, France

"Kunststoffe"
Carl Hanser Verlag
Leonard Eck Str. 7, Munich 27,
Germany

"Kunststoff-Rundschau"
Brunke Garrels, Verlagsbuchhandlung
Borgfelder Strasse 83, Hamburg 26,
Germany

"Materials in Design Engineering"
Reinhold Publishing Corp.
430 Park Ave., New York 22, N. Y.

"Materie Plastiche"
Via Farneti 8, Milan, Italy

"Matiéres Plastiques"
Galerie du Center, Bloc 3
Rue des Fripiers, Brussels, Belgium

"Mechanical Engineering"
American Society of Mechanical Engineers
29 W. 39th St., New York 18, N.Y.

"Modern Plastics"
575 Madison Ave., New York 22, N.Y.

"Oesterreichische Plastic-Rundschau"
Ployer & Co.
Aegidiengasse 5, Vienna 6, Austria

Plastics Age Company, Ltd.
Nihonbashi-Houcho—4. chome,
Chuo-Ku, Tokyo

"Plaste und Kautschuk"
Veb Verlag Technik
12 Unter den Linden
Berlin N.W. 7, Germany

"Plastic"
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31 Vester Farimogsgade
Copenhagen 5, Denmark

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Kunststoffeninstituut T.N.O.
Julianalaan 134, Delft, The Netherlands

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Temple Press, Ltd.
Bowling Green Lane, London E.C.I.
England

Plastics Age Co., Ltd.
34 Higashi-Shimizu-machi
Minami-ku
Osaka, Japan

"Plastics World"
Cleworth Publishing Co., Inc.
1 River Road, Cos Cob, Conn.

"Plastiques Informations"
94 Rue Saint-Lazare
Paris 9e, France

"Plastverarbeiter"
Rudolf Zechner Verlag, G.m.b.H.
Speyer/Rhein, Germany

"Poliplasti"
E.T.A.S., Via Andrea Mantegna 6,
Milan, Italy

"Practical Plastics"
Box 4850
G.P.O. Sydney, Australia

"Revista de Plastics"
Inst. "Alonso Barba"
Serrano 119, Madrid, Spain

"Rubber and Plastics Age"
Rubber and Technical Press, Ltd.
Tenterden, Kent, England

"SPE Journal"
65 Prospect St., Stamford, Conn.

"Spectator"
Published by New England Chapter
Society of Plastics Engineers, Inc.
Somers, Conn.

"Transactions of the Plastics Institute"
6 Mandeville Place, London W.1.
England

"Western Plastics"
Western Business Publications
274 Brannan Street
San Francisco 7, Calif.

Patent Digest

Materials

Composition Comprising a Mixture of Synthetic Resins and Cellulose Acetate Butyrate for Printing on Vinyl Plastics. No. 2,872,432. G. F. Goldstein, New York, N.Y. (to Interchemical Corp., New York, N.Y.).

This composition is a volatile, organic solvent solution of a vinyl chloride-vinyl acetate copolymer, a lower alkyl methacrylate resin, and cellulose acetate butyrate.

Process for Reclaiming Nylon. No. 2,872,420. P. C. Kruyff, New York, N.Y. (to Foster Grant Co., Inc., Leominster, Mass.).

Pure linear polyamide can be prepared from linear polyamide-containing stock.

Process of Preparing Urea-Formaldehyde Molding Composition. No. 2,872,425. A. R. Paz, Bound Brook, N.J. (to American Cyanamid Co., New York, N.Y.).

A thermosetting molding composition is prepared by blending two substantially-unalkylated, aqueous urea-formaldehyde resin syrups.

Beta-Acetoxyethyl Siloxanes. No. 2,872,434. G. H. Barnes, Jr., Pittsburgh, Pa. (Dow Corning Corp., Midland, Mich.).

A polymeric organosiloxane.

Organic Silicon Compounds and Methods for Making Them. No. 2,876,234. M. J. Hurwitz, Elkins Park, and P. L. de Benneville, Philadelphia, Pa. (to Rohm & Haas Co., Philadelphia, Pa.).

Method of Making Copolymer of Diisocyanate Modified Polyester and Vinylidene Monomer. No. 2,879,248. G. Nischk, Leverkusen, K. E. Muller, Leverkusen-Bayerwerk, and L. Goerden, Oedt, Germany (to Farbenfabriken Bayer Aktiengesellschaft, Leverkusen, Germany).

Polymethyl Methacrylate Polymer in Admixture with 2 Butene 1,4 Diol Dimethacrylate. No. 2,877,205. J. Lal, Philadelphia, Pa. (to H. D. Justi & Son, Inc., Philadelphia, Pa.).

Process for the Peroxide Treatment of Blends of Polymers of 1-Olefins and Hydrogenated Diene Polymers and Products Thereof. No. 2,877,206. H. N. Scott, Bartlesville, Okla. (to Phillips Petroleum Co.).

Polyurethane Polymer Containing a Metallic Dicyanamide. No. 2,877,192. J. Burkus, Pompton Plains, N. J. (to U. S. Rubber Co., New York, N. Y.).

Polyurethanes from Difunctional Polymers of Conjugated Dienes. No. 2,877,212. K. L. Seligman, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Process for Polymerizing Completely Halogen-Substituted Ethylenes. No. 2,877,217. B. R. Thompson and D. M. Young, Charleston, W. Va. (to Union Carbide Corp.).

Substituted Ureas. No. 2,877,268. F. Applegath and R. A. Franz, El Dorado, Ark. (to Monsanto Chemical Co., St. Louis, Mo.).

Improving Color Stability of Alkyl Phenols. No. 2,877,273. H. I. Enos, Jr., Wilmington, Del. (to Hercules Powder Co., Wilmington, Del.).

Compositions of a Copolymer of an Alkoxyalkyl Alpha-Alkyl Acrylate with Acrolein and an Organic Heavy Metal Salt Drier. No. 2,876,211. M. E. Cupery, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

(Cyanoalkoxy) Alkyl Substituted Organosilicon Compounds. No. 2,872,435. J. L. Speier, Jr., Pittsburgh, Pa. (to Dow Corning Corp., Midland, Mich.).

This compound contains a monovalent hydrocarbon radical free of aliphatic unsaturation linked to Cl, Br, or alkoxy radicals.

Polymerization Catalyst and Process. No. 2,872,439. W. F. Gresham and N. G. Merckling, Wilmington, Del. (to E. I. du Pont De Nemours & Co., Wilmington, Del.).

Ethylene is polymerized in the presence of an inert liquid hydrocarbon by contacting it with a tungsten chloride-tin tetraalkyl reaction product.

Adhesive Coated Plastic Material. No. 2,877,141. T. H. Shelley, Jr., Milltown and R. N. Zirnite, New Brunswick, N. J. (to Johnson & Johnson).

Heat-Stabilized Polychlorotrifluoroethylene. No. 2,879,257. A. T. Walter, South Charleston, W. Va., and Donald M. Young, New York, N. Y. (to Union Carbide Corp.).

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Prices, 25¢ each.
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A division of Rona Laboratories, Inc.
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Plants: Maine New Jersey Canada

Composition Comprising a Diisocyanate odified Polyester and Polymerized Vinyl loride. No. 2,872,430. J. A. Parker, ncaster Township, and J. Versnel, Manor wnship, Lancaster County, Pa. (to rmstrong Cork Co., Lancaster, Pa.). This blended mixture is a binder system r surface covering materials.

Composition of a Polymer of an Alkoxyalyl Alpha-Alkyl Acrylate, and Heavy Metal Salt Dried and an Aldehyde. No. 2,876,212. M. E. Cupery, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Method for Heat Treating Oriented Fibers of Blended Polyvinyl Chloride Polymers and Cellulose Acetate and Products Produced Thereby. No. 2,877,084. E. M. Diss, Sanford, and R. R. Walker, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

Method of Preparing Elastomeric Pastigels. No. 2,872,429. M. M. Schwartz, Jersey City, N.J.

A vinyl chloride-vinyl acetate copolymer, an ethyl methacrylate-methyl methacrylate copolymer, and ethyl methacrylate homopolymers are blended at room temperature and atmospheric pressure with a plasticizer and an alkyl lactate gelling accelerator.

Polymerization of Acrylonitrile and Another Unsaturated Monomer, in the Presence of Preformed Homopo' ymens and Products Obtained Thereby 253. H. W. Coover, Jr., No. 2,879,- (to Eastman Kodak Co., Kingsport, Tenn. N. Y.) Co., Rochester,

Polyurethane Resin Cr slinked with Polythioether and Vi ylidene Monomer and Process of Making Same. No. 2,879,-250. K-H Eisenmann, Koln-Stammheim, G. Nischk, Leverkusen, and H. Holtschmidt, Koln-Stammheim, Germany (to Farbenfabriken Bayer Aktiengesellschaft, Leverkusen, Germany).

Accelerator. No. 2,879,251. N. V. Seeger, Cuyahoga Falls, and T. G. Mastin, Akron, O. (Goodyear Tire & Rubber Co.).

Stabilization of Polyurethane Reaction Products. No. 2,877,193. P. A. Roussel, Wilmington, Del., (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Polyvinyl Halide Composition Containing Oxidized Polyester Resin, and Method of Making Same. No. 2,877,203. A. K. Forsythe, Manor Township, Lancaster County, and J. A. Parker, Lancaster Township, Lancaster County, Pa. (to Armstrong Cork Co., Lancaster, Pa.).

Process for Converting a Xylene Feed Mixture to Para-Xylene and Styrene. No. 2,879,313. C. B. Scott, Pomona, and W. D. Schaeffer, Ontario, Calif. (to Union Oil Co. of California, Los Angeles, Calif.).

Hardenable Mixtures of Unsaturated Polyesters and Polymerizable Ethylene Derivatives and Process of Making. No. 2,879,249. K. Raichle, H. Schweeberg, and H. Schneil, Krefeld-Uerdingen, Germany (to Farbenfabriken Bayer Aktiengesellschaft, Leverkusen, Germany).

Method of Making Destaticized Synthetic Resin. No. 2,879,244. M. A. Coler, New York, N. Y.

Polymeric Emulsifying Agents and Their Derivatives. No. 2,874,15' Medalia, Belmont, and H. H Brookline, Mass. and A. A. I. Freedman,

Proce crys er of Oxidizing Mixture of Microalline Wax, Hydroxylated Polyethyl- and Polyethylene, and Product Produced Thereby. No. 2,879,237. **Process of Oxidizing Mixture of Microcrystalline Wax, Monocarboxylated Polyethylene and Polyethylene, and Product Produced Thereby.** No. 2,879,238. Process of Oxidizing Mixture of Microcrystalline Wax and Two Polyethylenes of Different Molecular Weight, and Product Produced Thereby. No. 2,879,239. **Process of Oxidizing Mixture of Microcrystalline Wax, and Ester of Hydroxylated Polyethylene and Polyethylene, and Product Produced Thereby.** No. 2,879,240. **Process of Oxidizing Mixture of Microcrystalline Wax, an Ester of Monocarboxylated Polyethylene and Polyethylene, and Product Produced Thereby.** No. 2,879,241. M. De Groote, University City, and F. E. Mange, Clayton, Mo. (to Petrolite Corp., Wilmington, Del.).

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2,898,635 OWENS-ILLINOIS (Burch)
#2,787,023 KAUTEX (Hagen)
435,547 KAUTEX (Hagen)
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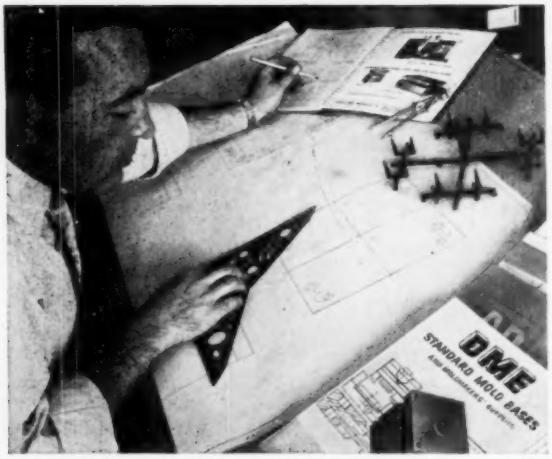

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Patent Digest (Cont'd.)

Plastics-Treating Apparatus. No. 2,879,396. J. F. McDonald, Carle Place, N. Y.

Apparatus for Curling Plastic Yarn. No. 2,878,514. V. L. Nichols, Bergenfield, and I. J. Carshelis, Linden, N. J. (to David & David, Inc., Brooklyn, N. Y.).

Process and Apparatus for Producing Molded Articles. No. 2,878,727. Cornelis Groot, Amsterdam, Netherlands.

Apparatus for Polymerizing Vinyl Monomers. No. 2,872,706. D. G. Jordan, Stamford, Conn. (to American Cyanamid Co., New York, N. Y.).

Apparatus for Stretching Plastic Interlayers. No. 2,873,474. G. B. Shields, New Kensington, and R. D. Stepp, Kittanning, Pa. (to Pittsburgh Plate Glass Co., Allegheny County, Pa.).

Injection Molding Machine with Weigh-feeder and Plunger Position Control. No. 2,873,478. W. J. Schieser, J. F. Kelley, and D. G. Marshall, Columbus, O. (to National Industrial Products Co., O.).

Extrusion Apparatus with Stock-Displacing Discharge End on Feed Screw. No. 2,878,512. R. Davis, Mystic, Conn. (to Standard Machinery Division, Franklin Research Corp., Mystic, Conn.).

Apparatus and Process for Centrifugal Molding of Articles from Thermoplastic Materials Which Exhibit Substantial Volumetric Shrinkage. No. 2,874,412. N. A. Flemming, Reading, and E. E. Montross, West Wyomissing, Pa. (to Polymer Corp., Reading, Pa.).

Applications

Plastic Valve. No. 2,865,596. A. B. Mounig, Cincinnati, O. (to Lunkenheimer Co., Cincinnati, O.).

A molded, axial valve body includes tubular inlet and outlet conduits, a barrel, a conical sealing flange, and a multi-diameter plastic sleeve. The flange, which sits on the rigid wall, will deform under normal operation. The wall is adapted, on translation of the sleeve by rotation, to engage with or disengage from the flange, thus closing and opening the valve.

Compound Bearing with Synthetic Resin Layers. No. 2,865,692. R. Gossmann, Laucherthal, Sigmaringen, Germany.

At least two thin resin layers are superimposed on a metal shell. The inner resin layer contains mica, which causes the formation of capillaries, while the outer layer, which protects the metal shell from lubricant contact, is a curable resin of the epoxide and phenol formaldehyde class.

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Colors

Eagle-Picher alsilox, lead monosilicate, litharge	lb.	$0.1475
Orange mineral AAA	lb.	.175
Red lead	lb.	.1525
Sublimed litharge	lb.	.1485
Harwick Stan-Tone D-1100	lb.	2.55 / 2.80
-1101	lb.	.69 / .94
-2000	lb.	1.25 / 1.50
-2110, -2120, -2121	lb.	.98 / 1.23
-2200	lb.	1.47 / 1.72
-2500, -2800	lb.	1.90 / 2.15
-2501	lb.	1.15 / 1.40
-2600, -2602	lb.	4.60 / 4.85
-2601	lb.	1.60 / 1.85
-2700	lb.	1.75 / 2.00
-4000	lb.	2.90 / 3.15
-4001	lb.	2.75 / 3.00
-4002, -5001	lb.	.90 / 1.15
-4003	lb.	3.20 / 3.45
-5000	lb.	3.35 / 3.60
-5400	lb.	1.50 / 1.75
-7001	lb.	2.80 / 3.00
-7002	lb.	2.98 / 3.18
-7003	lb.	3.97 / 4.17
-7004	lb.	4.23 / 4.43
-7005	lb.	4.68 / 4.88
-7006	lb.	4.89 / 5.09
-7104	lb.	1.85 / 2.05
-7105	lb.	1.97 / 2.17
-7106	lb.	2.20 / 2.40
Sandoz Acetosol solvent dyes		
Red 4 BLS p.a.f.	lb.	$8.25
Yellow 5GLS p.a.f.	lb.	9.95
RLS p.a.f.	lb.	10.00
Graphtol aqueous dispersions		
Black	lb.	.38
Navy	lb.	.66
Reds	lb.	1.05 / 1.23
Vat oranges	lb.	3.60
Yellows	lb.	.64 / .70
Graphtol organic pigments		
Blues, phthalocyanine	lb.	2.25 / 2.90
Vat	lb.	16.20 / 16.25
Victoria molybdate	lb.	4.95
Greens, phthalocyanine	lb.	3.15 / 3.35
Pigment green	lb.	$1.50
Oranges, vat	lb.	15.49 / 18.00
Reds, naphtol	lb.	5.00
Permanent red 2B	lb.	1.90
Pigment scarlet	lb.	1.75
Yellows	lb.	3.50
Nitro Fast oil colors		
Green GB	lb.	6.13
Orange GC, SG	lb.	1.38
Red B	lb.	1.94
Violet RS	lb.	6.81
Nylofil phthalocyanine specialties		
Blue BLL	lb.	4.70
Green GTL	lb.	13.00
Sherwin-Williams blues	lb.	.80 / .3
Flushed in DOP	lb.	1.05 / 1
Greens	lb.	.42 / .5
Flushed in DOP	lb.	.78 / 1
Maroons	lb.	.98 / 4
Flushed in DOP	lb.	3.40
Oranges	lb.	.35 / .3
Flushed in DOP	lb.	.54 /
Reds	lb.	.98 / .5
Flushed in DOP	lb.	.48 /
Whites	lb.	.083 /
Flushed in DOP	lb.	.37 /
Yellows	lb.	.35 /
Flushed in DOP	lb.	.48 /

Fillers

Harwick Natka 1200 clay	ton	13.00 /

Plasticizers

Chlorowax 40	lb.	.15 /
50	lb.	.16 /
70	lb.	.185 /
70-S	lb.	.21 /
LV	lb.	.17 /
Eastman polymeric plasticizer NP-10	lb.	.44 /

CALENDAR of COMING EVENTS

March 30-31
Plastics Institute. Conference on Polymeric Progress. William Beveridge Hall, London University, London, England.

April 5-7
Building Research Institute Spring Conferences: Plastics Information Workshop. Statler-Hilton Hotel, New York, N. Y.

April 7-8
SPI Seventeenth Annual Western Section Conference. New Riviera Hotel, Palm Springs, Calif.

April 20
SPE North Texas Section RETEC. Plastics in the Petroleum and Chemical Industries. Hotel Texas, Fort Worth, Tex.

April 20-21
SPI Cellular Plastics Division Automotive Conference. Statler Hotel, Detroit, Mich.

April 20-22
SPI Third Annual Fluo
Division Meeting. Hotel
New Orleans, La.

April 25-26
SPI Eighteenth Annual
Section Conference. L
tel, London, Ont., Can

May 14-29
Foire de Paris. Sixth I
Plastics Materials a
Parc des Expositions, P

May 20-31
Norsk Plastforening.
Plastics Exhibition. C

May 23-26
ASME Design Engine
ence and Show. Stat
tel, New York, N. Y

uction and Sales of Plastics and Resin Material, September and October, 1959

he partly estimated and revised domestic production and sale of ous material during the months d October, 1959. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

	September, 1959		October, 1959	
	Production	Sales	Production	Sales
	1,545,809	1,498,095	1,689,668	2,021,246
	1,829,111	1,798,222	2,230,932	2,194,670
es (including other cellulose plastics)	811,692	866,919	785,107	995,697
ncluding other cellulose plastics)	8,876,780	8,788,841	9,518,807	9,572,189
ubes	246,769	164,700	243,376	162,357
TOTAL	13,310,161	13,116,777	14,467,890	14,946,159
ns:				
	20,247,773	18,242,820	20,326,249	18,589,853
—				
	7,151,065	5,075,319	6,364,169	4,310,003
	1,436,373	1,342,443	1,372,427	1,101,391
s, clutch facings, and similar materials)	1,451,630	1,393,838	1,625,955	1,389,268
rock wool)	4,370,782	4,620,433	4,251,726	3,983,376
	5,959,444	4,846,906	4,903,657	3,931,403
e uses	5,289,883	5,309,431	6,434,063	5,430,031
odified and modified except by rosin	2,271,694	1,690,688	2,421,561	1,893,445
	4,081,231	3,897,202	4,653,373	4,344,423
TOTAL	52,259,875	47,419,080	52,353,180	39,543,153
ating resins	2,687,613	2,425,608	2,481,115	2,665,517
g resins	2,571,655	2,274,032	2,395,195	2,271,172
s for—				
	3,494,265	2,611,288	3,880,916	2,755,540
	9,002,997	9,797,844	9,122,645	9,176,929
esive uses	1,780,746	1,875,477	2,149,995	1,750,707
night and modified	3,713,943	2,737,888	3,427,563	2,430,901
uding molding	11,513,536	10,446,441	12,974,042	11,000,413
TOTAL	34,764,755	32,168,578	36,431,471	32,051,179
erials:				
	23,973,549	22,782,258	25,276,020	23,793,740
	34,217,064	28,908,149	35,790,908	31,461,795
	6,860,122	6,313,492	6,834,509	5,544,457
and coating resins	5,444,208	4,219,125	6,835,538	3,920,449
	12,194,101	15,496,167	11,035,711	15,530,876
TOTAL	82,689,044	77,719,191	85,772,686	80,251,317
sins:				
olymer resins (50% or more PVC) for—				
		7,112,128		8,637,553
		11,274,858		12,604,462
resin content)		28,105,736		30,837,749
ng and coating (resin content)		6,386,877		4,898,325
		11,938,540		14,211,979
n content)		2,004,356		2,926,966
ntent)		7,644,301		8,615,210
—				
nt)		5,166,864		5,715,887
sin content)		2,075,119		2,455,945
ntent)		9,464,512		10,966,123
TOTAL	98,924,036	92,073,291	105,558,047	101,870,199
troleum Polymer Resins	23,062,745	24,114,973	23,915,787	22,885,844
	9,300,784	8,483,025	9,325,599	8,307,125
	1,752,509	1,692,826	1,685,173	1,670,401
TOTAL	11,053,293	10,175,851	11,010,772	9,977,526
		29,617,149		31,688,358
		18,761,354		19,721,034
		12,987,017		15,126,125
		41,499,604		30,592,989
TOTAL	104,615,636	102,865,124	109,337,875[1]	97,128,506[2]
s		1,829,832		1,963,385
		1,871,540		2,190,469
TOTAL	4,970,453	3,701,372	5,368,174	4,153,854
Plastics and Resin Materials, Including Silicone Resins	22,779,507	18,200,366	20,305,676	17,667,253
GRAND TOTALS	448,429,505	420,554,603	464,521,558	420,474,990

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d States Tariff Commission, Chemical Division.

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